

V. Technology Environment

The purpose of this assessment is to provide a summary overview of the condition of the County's technology environment. The assessment provides a baseline against which to compare agency needs and will assist in setting the County's new direction. The assessment has been written for use by executive management in support of planning and decision making. Multiple sources of information were used to develop this assessment. The primary sources included agency business plans, technical documentation, interviews with management and staff, technical surveys, supplemental questionnaire responses, and observations of agency operations. During the County's Strategic Technology Planning project every attempt was made to collect a comprehensive set of data. While a great deal of information was provided, not all agency information was available to support the planning analysis. In some cases, agencies did not have all the information requested; some data provided did not make sense; some data was missing; and because of time constraints, the study proceeded without all information being made available. As a result of the data constraints, it is possible that some data may be in error.

The analysis is categorized into six sections: (1) commendations, (2) service delivery, (3) operations, (4) architecture, (5) management and organization, and (6) funding. Each technology component has been described in a narrative and supplemented through bulleted lists of strengths, weaknesses, and findings.

Commendations

This assessment provides a constructive critique of the County's technology environment, with a particular emphasis on areas where improvements may be made. Because of this emphasis, the assessment spends limited discussion highlighting strengths of the organization. However, it should be recognized that many strengths exist within the County's technology environment. Of the many, we list a few of the most significant here and commend the County's staff for their diligence and expertise in establishing and operating the existing environment.

1. Staff Commitment

Technology staff around the County have taken ownership for operating current systems and meeting end-user needs. The strong commitment is evident in the amount of effort and hard work being devoted to the job and in favorable feedback from the user base.

2. Technical Skills

Many of the hundreds of technology staff employed by the County have honed their technical skills at a high level with respect to operating existing technologies that are in place today.

3. Recognized Need For Change

Management and staff are keenly aware of the need to migrate to newer, state-of-the-art technologies, including the Web. This awareness is based upon understanding of the importance of increasing efficiencies, integrating systems, enhancing service delivery to the public, sharing data, maintaining systems, and using funds more wisely.



4. Newly Established Governance Process

Driven by Council and Executive demands, the new technology governance process has brought increased accountability and oversight into the technology arena. This process is already resulting in strengthened system planning and design, improved analysis, and better decision making.

5. Computing Architecture Stability

Through the variety of architecture utilized, the computing power and capacity of the County's infrastructure is providing solid support to deliver information services. Key components of the County's architecture include hardware, operating systems, databases, and active electronics.

6. Wide Area Network

The County's wide area network reaches virtually every employee at the County, connecting people and providing access to applications and data. The WAN is operating reliably and supports enterprise applications including e-mail.

7. Specialized Software

Much of the foundation of the County's infrastructure was put into place throughout the 1980s and 1990s. This software is operating today to meet the specialized needs of individual agencies. Representative examples of specialized software are found at Transit, Public Health, and the Department of Development and Environmental Services (DDES).

8. Enterprise Computing

During the late 1990s the County established a basic foundation for enterprise technology. This foundation includes the wide area network, telephony, messaging, voice mail, and e-mail. The established core infrastructure provides the basics to build upon. Recent progress has been made related to strengthening GIS capabilities.



A. Service Delivery

Service delivery is how information and technology services are provided to the public, employees, government agencies, and businesses. Several of the service delivery areas are considered to have strategic implications. Weaknesses of particular concern include the lack of the following:

- Formal agreements between service providers and customers, in which performance commitments and expectations are set and documented in the form of service-level agreements
- Coordination between the various help desk functions that are located around the County
- Knowledge about Web technologies and the resulting impact on system development and deployment
- Progress related to deployment of specific applications on the Internet providing public information and services
- Migration of the County's technology embracing the employee intranet and partner extranet.

Related service delivery discussion is also found in the Operations section of the assessment under Distribution of Technology, Maintenance/Upgrades, Technical Security, Systems Administration, Telecommunications, E-Mail Services, Voice Messaging, Data Management, Backup and Restoration, and in the Architecture section under Internet, Intranet, and Extranet.

A1. Service-Level Agreements/Performance Measurement

Service-level agreements (SLAs) are contracts that document what services are to be provided from technology personnel to end-user customers. A limited number of these agreements are in place currently at the County, covering (1) server operations, (2) LAN and e-mail,

(3) voice systems, (4) distributed computing, and (5) Web hosting. Some agreements appear to be thorough (server operations), while others are in need of improvement (LAN administration). Other areas such as mainframe, WAN, and applications support services are lacking SLAs. To the extent that SLAs exist, they vary greatly in age, formality, and use. There are a number of agencies that also have established SLAs with vendors including Finance, DSS, and Public Health. No standards exist at the County in terms of what constitutes an SLA. Further, monitoring processes are also not defined. Finally, managers report difficulty meeting commitments made in SLAs given the limited amount of resources available. Table 1 illustrates the degree to which agreements exist internally for ITS services.

Findings:
<ul style="list-style-type: none">– Some agreements exist for key functions, including some servers and the centralized help desk.– SLAs do not exist for most systems.– Those that do exist are not generally actively managed.



Table 1: ITS Service-Level Agreements

Relevant Services	SLA in Place?	Status
Mainframe and Networking	No	No agreements in place.
LAN and Mail	Yes	Minimal and dated agreements exist but are not monitored.
Distributed System Services (DSS)	Yes	SLAs document the service to be provided and the staff hours committed to each server or application. Some customers have not signed the agreements.
Application Development and Systems Support	No	Agreements were in place in the past but were discontinued.
Help Desk	Partial	Agreements define escalation procedures; define responsibilities of central help desk and supporting agency staff.

When considering the associated function of performance measurement, it is apparent that SLA monitoring is conducted on a limited basis. In general, performance metrics are not tracked or used effectively.

<i>Strengths:</i>	✓ Hosted servers and outsourced services have viable agreements in place.
	✓ Service providers and many users are aware of the need for agreements.
<i>Weaknesses:</i>	✓ Few service-level agreements exist across the County.
	✓ Those that are in place are not actively managed.

A2. Support/Help Desk

Help desks are located centrally within ITS and also within several agencies that operate their own technology groups. Agency help desks primarily focus on support of agency-specific applications as well as desktop issues. The two largest decentralized help desks are located within Public Health and Finance.

Findings:
– Numerous help desks are in operation supporting Countywide applications, offering some overlapping services.
– Agency help desks do not coordinate efforts on an enterprise level.
– Help desk functions have developed over the years in an ad hoc manner.

Help desk personnel provide a central source of assistance to end-users. The help desks do not have extensive resources to draw upon, and as a result provide a fairly narrow scope of assistance and often miss the root cause of problems that are reported. Perhaps the most significant issue pertaining to the County's help desk is that the multiple groups are not well coordinated. The lack of coordination is rooted in the ad hoc manner in which the functions have been established. This lack of coordination misses the opportunity to optimize use of help desk resources and also the opportunity to better serve end-users. Issues that beleaguer the function include difficulties in handling concurrent calls, lack of standard procedures, and narrow skill sets, making it difficult to



service the broad array of systems operated around the County. The centralized help desk and several others are discussed further below.

a) Centralized Help Desk

The centralized help desk supports all County users and operates Monday through Friday, 6:30 A.M. to 5:00 P.M. The help desk generally focuses on problem management for network messaging, telephony, and data center issues. The ITS help desk operates with three core staff and is theoretically servicing up to 10,000 end-users. Because other County agencies utilize internal help desk resources, it is difficult to verify the number of users actually supported. The estimated total call volume is 1,200 calls per month, with each call lasting an average of three minutes.

The help desk software used centrally is HEAT, developed by FrontRange Solutions Inc. The package has been extensively customized to meet County needs. Ongoing report generation and vendor support have been hampered by the customized code. The upgrade process has also been affected, which has resulted in the process being more cumbersome and time-consuming. ITS is considering converting to the standard version of HEAT to take advantage of the software's reporting and query functions.

The process followed when a request is made is as follows. Initially, when calls are received the help desk technician attempts to answer the call on the spot. If the help desk technician is unable to fix the problem, a ticket is routed through e-mail to a specific group of specialized personnel (HEAT routes these tickets automatically). The help desk assigns tickets to "groups" of technicians, not individuals. The group lead then delegates specific tasks to technicians. With the exception of staff follow-up, there is no system in place for tracking open issues or resolution. The leads are responsible for checking on open HEAT requests. Generally, technicians are not dispatched out into the field; instead, most issues are referred to agency LAN administrators for follow-up.

After-hours support requests are routed to operations staff who provide 24x7 service. For emergencies, operations staff know which technicians to contact. Operations staff enter tickets and serve as an escalation point to the technicians. There are few performance metrics against which help desk staff measure performance or shortcomings. Currently the primary unit of measure is the number of calls received per week. Information regarding actual call volumes or average length of call is not currently available for after-hours support.

b) Decentralized Agency Help Desks

Public Health, Finance, the Department of Natural Resources, and the Department of Development and Environmental Services operate their own help desks. These agencies operate significant systems and support many hundreds of end-users. Specific attention is provided in these operations to supporting software applications.



(i) *Public Health*

Public Health operates its own help desk because of the specialty applications used, although the help desk also supports standard Countywide applications. Public Health's help desk is staffed by two full-time analysts. Issues are either resolved immediately at the desk or routed to appropriate on-site personnel. The help desk supports over 1,800 employees.

(ii) *Finance*

The Finance Department help desk is primarily responsible for supporting PeopleSoft software, although users also obtain assistance for Countywide applications. Support is also provided for bank financial software, Integrated Business Information Systems (IBIS), Advanced Purchasing Inventory Control System (ADPICS), and the Management Service America (MSA) system.

(iii) *Department of Natural Resources and Parks (DNRP)*

Each of the four divisions of DNRP provides support to its own staff:

- The Solid Waste Division help desk responds to e-mail requests for assistance. The goal of this group is to respond to requests within 30 minutes. After-hours calls from the transfer stations are responded to immediately, and office staff requests are handled on the next business day.
- The Water and Land Resources Division help desk responds to approximately 170 calls per week, with an average response time of 35 minutes. After-hours calls from the flood warning center and EOC are responded to immediately, and other after-hours calls are handled the next business day. An estimated 70 percent of the help desk calls are answered at the point of contact.
- The Wastewater Treatment Division help desk responds to calls during business hours, with an average response time of two hours. Emergency after-hours calls are dealt with immediately, and nonemergency after-hours calls are handled the next business day.
- The Parks Division help desk responds immediately to after-hours emergencies, with other after-hour calls being handled the next business day. Approximately 80 percent of calls are responded to at the point of contact.

(iv) *Department of Development and Environmental Services (DDES)*

The DDES help desk responds to approximately 300 calls per month, with an average response time of one business day. Approximately 75 percent of the calls are answered when person-to-person contact is made. After-hours calls are tracked by voice or e-mail and responded to the following business day. For hardware, DDES utilizes automated equipment failure notification received by the LAN Administrator/Unix System Administrator. DDES software applications are fully supported by internal agency staff. Each application is assigned a primary and a backup support staff member.



A summary of agency help desk functions is provided in Table 2. Information about the Judicial Administration help desk functions was limited to that provided in the table.

Table 2: Agency Help Desk Functions

Agency	Help Desk Hours	Tools (Status)
Public Health	7:00 a.m. – 5:00 p.m. weekdays	None reported
Finance	7:00 a.m. – 4:00 p.m. weekdays	None reported
DNRP <ul style="list-style-type: none"> • Solid Waste • Water and Land Resources • Wastewater Treatment • Parks 	Each division has help line and e-mail notification. 7:00 a.m. – 5:00 p.m. weekdays Pager: 8:30 a.m. – 11:30 p.m., 7 days/week 7:30 a.m. – 6:00 p.m. weekdays Pager: 24 hrs, 7 days/week 8:00 a.m. – 5:00 p.m. weekdays 8:00 a.m. – 5:00 p.m. weekdays Pager: 24 hrs, 7 days/week	Help desk management software. WLRD has a help desk database and is developing a Web-based front end that will allow desktop users to submit requests and provide technicians with the flexibility to enter data from any location.
DDES	6:00 a.m. – 5:30 p.m. weekdays	HEAT (shared software with ITS)
Judicial Administration	8:30 a.m. – 4:30 p.m. weekdays	Currently searching for Help Desk software package

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Standards specify response times. ✓ Agency help desks provide support focusing on specific applications and desktop support. ✓ A centralized help desk application (HEAT) is in use at ITS. ✓ After-hours emergency response processes are in place for many systems.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ There is limited reporting available to track and measure performance. ✓ Help desk boundaries and responsibilities are loosely defined across the County. ✓ The customization that has been done to HEAT impairs some functionality and impacts the upgrade process.

A3. Outsourcing

While no firm numbers were provided on this study, the County appears to make modest use of outsourcing as a way to access needed resources and provide services to end-users. What outsourcing has been pursued has been tactical in nature, as opposed to strategic, whereby a formal effort was made to contract out specific categories of service. When outsourcing is used, it appears to be primarily for two reasons: the need to access technical assistance, and for backup analytical and managerial purposes. Outsourced technical services that have been acquired include telecommunications engineering and support, cabling, printer maintenance, and some aspects of I-NET operations. Over the years, outsourced services have also been procured for plans and particular analysis such as done recently in the

Findings:
<ul style="list-style-type: none"> – Used primarily to access technical assistance and for backup analytical and managerial purposes. – Occurs at a modest level. – Outsourcing is used as a tactical, rather than strategic, tool.



Mainframe Study and Financial System Review. These kinds of services are typically acquired on an as-needed basis. Lacking at the County has been adequate cost/benefit analysis to determine what activities should remain as core competencies internally (such as an administration) versus what services should be categorically outsourced to other entities. As in most organizations, outsourcing is a very sensitive topic at both managerial and employee levels. Other counties around the country make use of outsourcing in a number of technical areas. Peer information is available in the appendix to this report.

<i>Strengths:</i>	✓ Some modest use occurring related to telecommunications engineering and support, cabling, and printer maintenance.
	✓ Personnel recognize that not all needed skills are available from within the County.
<i>Weaknesses:</i>	✓ Little formal study has occurred related to the benefits of outsourcing.
	✓ Outsourcing not viewed as a strategic means to access additional resources.

A4. Development

Significant custom software development has occurred over the years, especially concentrating on the County's largest applications. Custom-developed systems include Financials, Assessment, and Public Health Tracking, to name a few. While continuous development is occurring, the programming approaches are not as up-to-date as they could be.

Findings:
– Continuous development is occurring throughout the County on major applications.
– End-user involvement is lacking at major points in the process.
– Most development processes are routine, but not robust.

Programmers exist centrally at ITS, decentrally within other agencies, and are also hired from outside the County. Currently there are no standard development methodologies in use across the County. Techniques followed tend to be traditional in terms of developing specifications and programming. Sophisticated, state-of-the-art, user-oriented, and rigorous development methodologies are for the most part missing. Areas where improvements may be made include (1) using advanced process and data modeling techniques, (2) utilizing automated programming tools, (3) employing iterative development processes, and (4) involving end-users more extensively in design and test functions. All of these improvements would potentially strengthen program delivery in terms of timing, software functionality, and ultimately systems efficiency. System development efforts are occurring centrally as well as at the agency level and include Web applications, traditional systems, and reporting. Development is further discussed below in terms of these categories.



a) *Web Application*

ITS hosts the links to about 75 percent of the Web applications in use on County servers. Web deployment is predominately accomplished within the agencies. ITS also has its own Webmaster for application development and support. The Web applications are hosted within ITS on the 24th floor of the Key Tower, although agencies may also host applications on their own servers.

There are minimal development standards in place to guide development related to the County's intranet. All agencies have the latitude to establish their own systems. As a result, intranet Web applications are being developed by independent developers, supported by few guidelines to govern these activities. Some agencies appear to be duplicating development efforts since there is limited knowledge transfer across agency boundaries. Although development standards are largely missing across the County, there are some exceptions. Within ITS for example, development personnel generally follow standards related to "look and feel," meeting the standards for graphics, layout, etc. Subsequent to development, agencies are responsible for managing their own content. Some agencies, such as the Department of Natural Resources, also have formal Internet and intranet standards for use within agency boundaries, and development teams meet regularly to support such standards.

b) *Traditional*

Many agencies develop systems using conventional programming techniques. Larger, better-funded agencies such as DOT, DDES, DNR, and the Sheriff's Office are building custom systems. While many of the larger agencies program their own systems, many of the CX agencies rely on assistance from ITS' applications group to assist in the development process. One particularly good example of traditional development is found in the Assessor's Office, where a multiyear project is progressing to redevelop the property tax system.

Most development efforts follow conventional development techniques. Tasks include requirements definition, specification development, programming, testing, conversion, and "go-live" activities. Cleanup occurs before and after implementation. Much of the development at the County is conducted to maintain legacy systems. This means that programmers are on staff continuously coding applications. Systems such as MSA payroll and ARMs financials are in a constant state of change. The Department of Health and LS&J agencies are likewise continuing to develop their own applications. For the most part, programming is conducted by internal County personnel. For many personnel, because they know the code so well, programming has become "second nature."

While programming efforts continue in conventional form, such efforts are not cutting-edge, using more rigorous analysis and programming techniques. For the most part, conventional approaches, languages, and tools are used. Development processes have not heavily utilized end-users. Further, development has generally not been iterative; does not rely on extensive research; and lacks standards in terms of tools, approaches, and code reutilization.



c) *Reports*

Generally, requests for new and updated reports are due to legal requirements, business process changes, or analytical reasons. The process to request and develop reports differs based upon the type of system. For example, staff are trained to write reports for the IBIS system. Experts are available to assist end users to write queries if help is needed. In contrast, ARMS users go to the programmer to seek development of a new report, or users conduct a data extract. For the new ARMS Web-enabled reports, the Web site provides an automated means for Web-users to submit a report request.

Other than the informal request processes mentioned above, there are generally no well-defined request mechanisms in place for end-users to follow. Report requests are typically submitted to the analysts directly. Sometimes, such as in the case of ARMS Web reports, requests are logged in and prioritized based on the nature of the request and availability of resources. In the case of PeopleSoft, report requests are submitted to operations team members directly. A Web-site report request function is available for end-users. This function automatically logs requests received and supports prioritization of report development.

While standard “canned” reports are provided out of systems, reports are routinely developed across the County using a variety of development tools. The tool sets used in development are of two general types: those that are purchased in conjunction with a particular system such as Oracle, and those that are stand-alone and generic such as Excel. Within decentralized agencies, a number of tools are used. These tools range from standard report writers to stand-alone packages that are used to extract, manipulate, and present data. Agencies reported the use of the standard tools as noted in Table 3.

Table 3: Reporting Tools Utilized

Agencies	Tools				Business Objects
	Crystal	Access	Excel	FRx	
Finance	X	X	X		X
Fleet Administration	X		X		
Public Defense					
Adult and Juvenile Detention	X	X	X		
OHRM and OCR	X	X	X		X
Prosecuting Attorney’s Office		X	X		
Road Services	X		X		
Metro Transit	X	X		X	X
Public Health	X	X	X	X	
DES	X	X	X		
Sheriff’s Office	X	X			
Superior Court	X	X	X		
Department of Assessments			X		
Natural Resources	X	X	X		X
Judicial Administration	X	X	X		
Airport	X	X			
Budget Office					



Beside the generic reporting tools in use, many reports produced are tied to Financial and Human Resource systems. For example, the IBIS team utilizes a set of tools for developing both standard and ad hoc reports. The IBIS team utilizes two Oracle-based products, Business Objects and Noetix Views.

County reports developed are categorized into three types: system reports, user-created reports, and Web-enabled reports. Report types are further described below:

(i) *System Reports*

Most major County systems provide a set of system-generated reports. In many cases these reports have been custom developed during the implementation process. Reports are, in the case of legacy systems (ARMS and MSA), centrally generated, printed, and distributed. For the newer Financial system IBIS, and Human Resource/Payroll PeopleSoft, reports are requested at the client desktop, executed on the server, and then printed at the local printer.

(ii) *User-Created Reports*

Users have the option of using common reporting tools, such as Business Objects (with the IBIS system), PeopleSoft Query (with the PeopleSoft system), or Crystal Reports. Reporting analysts are available to provide assistance with these tools, especially when queries are needed. Users have been trained to use PeopleSoft Query, but to date, few users have generated reports on their own. Users may also go into ARMS to extract data using MS Access.

(iii) *Web-Enabled Reports*

Numerous reports from IBIS, ARMS, and PeopleSoft systems are also available on the Web. Users have the option of selecting their own reporting parameters with these systems. Web reporting functions are simple to use and do not require advanced training. Consequently, these kinds of report functions have been well received, and departments report a steady stream of requests for additional Web-based reports.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ Agencies are able to take care of many of their own needs through the use of Microsoft Access and Visual Basic Development capabilities.✓ Many simple applications are built quickly for immediate use.✓ Internal programmers appear very competent, with some agencies having significant numbers of staff.✓ Because of the work done by ITS' Web team, to date there is consistent "look and feel" for many of the County's Internet applications.✓ Standard reports are available with many systems, along with tools to support further development.✓ Recent technology focused on the Web has provided easier access to development resources, with custom report capabilities available to meet the particular needs of end-users.
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<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ There is no party assigned the responsibility to manage development on an enterprise level. ✓ Countywide development standards have not been established. ✓ Minimal knowledge sharing occurs across agency boundaries. ✓ Generally, there is a lack of formal report request mechanisms to seek development assistance and access to information.
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A5. Data Entry

Data entry occurs throughout the County as end-users input and operate applications. The majority of data entry is originated at the source with end-users. There is, however, a critical centralized data entry system in operation named Pertec. This system is important for the payroll and other applications such as property tax billing. The system is accessed by dumb terminals located in Finance, Vital Statistics, Assessments, Courts, Public Health, and ITS. This system is at risk because of aging technology and a lack of hardware and software support. While the system itself is relatively small, it is tactically important because of the critical nature of the applications involved. ITS is in the beginning stages of acquiring a new system to replace this unstable hub.

Findings:
<ul style="list-style-type: none"> – Both centralized and distributed data entry is occurring around the County. – The central data entry system “Pertec” is vital to the County, particularly because it supports applications such as payroll. – The centralized system is aging, and a process to replace it is now underway.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ For some important systems with high transaction volumes, data entry is occurring efficiently through the use of the centralized Pertec system. ✓ Most data entry around the County occurs efficiently at the source with end-users.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ The current centralized system Pertec is at risk because of aging technology and a lack of support.

B. Operations

Operations are the practices employed to operate and sustain the technology environment. Several areas related to operations are considered to have strategic implications. Weaknesses of particular concern include the following:

- A lack of comprehensive asset management whereby assets are managed on an enterprise level rather than reactively within agencies
- Other than for the mainframe, few standard operating procedures are defined to guide those responsible for performing similar duties across the County
- A high level of vulnerability in the area of technology security related to internal and external threats
- A serious lack of business continuity planning, which will limit the County’s ability to recover in the event that technology fails for an extended period of time

Discussion related to operations is also found in the Architecture section under Network, Servers, Telephone and Voicemail, and Applications.



B1. Asset Management

Asset management is the discipline of planning, deploying, operating, and maintaining the asset base in good working order to achieve optimum efficiency and cost effectiveness. Financial aspects of asset management include tracking purchase costs, asset life, depreciation, and disposition data.

Very limited technology asset management is occurring around the County. This is especially noticeable when evaluating how servers and PC workstations are managed at ITS and within other agencies. It is apparent that limited planning is occurring to ensure that systems are adequately maintained after initial capital purchases are made. Hundreds of pieces of technology are left to age and operate with less than adequate attention. The lack of maintenance is costly in terms of the highly variable repair costs as well as lost productivity. Additional equipment that appears to be undermanaged includes PBXs and voice-messaging systems. Current asset management mainly involves inventory and theft prevention activities but does not include tracking depreciation or planning replacement.

Over the years, some attempts have been made to improve asset management. For example, within ITS there have been previous attempts to use Microsoft's Systems Management Server (SMS) to deploy and manage the County's software, but full implementation has never occurred because of the complexity of the software and network topology requirements. SMS is a software application primarily utilized for remote software deployment as well as for managing software and hardware assets. This tool may be utilized for asset management functions including discovering and tracking assets, deploying applications and software updates, as well as troubleshooting Windows-based systems. ITS has used SMS for some inventory management, but because SMS does not include cost or depreciation tracking, most of the more expensive capital equipment (e.g., switches, PBXs, etc.) are tracked through the use of stand-alone spreadsheets.

Additional asset management activities also occur within other agencies. For example, as part of the GIS consolidation that occurred in 2001, a "ground-up" GIS asset inventory was developed. This inventory is expected to be used as a basis for a better-managed asset replacement program in the future. Inventory is also tracked through both accounting functionality and an "internal list." Additionally, Transit uses Zenworks to support its annual software inventory process. In other instances, such as in the Department of Assessments, there is an asset management process that utilizes tracking tags and conducts annual inventorying, but does not utilize systems for tracking purposes.

Findings:

- There are some limited agency processes and workflows in place to manage technology assets.
- The current tools utilized for asset management do not include capabilities for monitoring financial expenditures.
- Concentration of activities has been oriented toward inventorying and theft prevention.
- Some asset management tools are being utilized, including SMS and ZenWorks.



<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ ITS is aware that asset management is conducted at minimal levels and is taking steps to improve the situation. ✓ Some agencies are actively tracking assets at reasonable levels. ✓ Physical protection of assets has been a priority.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ There is no Countywide asset management program in place. ✓ There is no “one central source” for conducting asset management and no standard practice for planning for replacement. ✓ There is a lack of understanding of the basic purpose of such a program.

B2. Business Continuity

Business continuity planning related to technology is seriously lacking at the County. While data backups exist, there are few plans in place that provide an adequate avenue to recover processing and communication capabilities should systems

go down for an extended period of time. A proper business recovery plan should include disaster recovery for data and system restoration as well as a means for establishing the continuity of such mission-critical functions as payroll, public relations, emergency response, and transportation. A review of the ITS backup plan confirmed that the disaster recovery area has not received much attention in recent years. A prime example of the lack of preparedness is that no alternative facilities are available to support the County in the event of disaster, nor is there adequate redundancy in hardware. Disaster recovery planning should be considered critical for the service centers, mainframe and servers, telephony infrastructure, and networks. Recently a subcommittee of the Technology Management Board has been formed to address disaster recovery and prepare a new plan. The new plan will identify which platforms are mission-critical and the priority of applications for recovery purposes.

Findings:
<ul style="list-style-type: none"> – Plans and preparation are lacking. – There is significant downtime exposure. – No alternative site is available in the event of a disaster.

<i>Strengths:</i>	<ul style="list-style-type: none"> • Agencies are aware that disaster recovery is a weakness and have immediate plans to address it. • A subcommittee has been formed to review and update the disaster recovery plan. • There is a previous but inadequate plan in place.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> • Current plans address data only. Hardware, infrastructure, telecommunications, and mission-critical operations are not covered. • No agency has been assigned or taken ownership/responsibility for Countywide planning. • No needs analysis has been performed to identify which operations should be included.



B3. Distribution of Technology

Technology distribution is associated with the update process whereby software and hardware are sent or “distributed” into agency environments. The process involves acquiring, preparing, and disseminating technologies out to where they are needed. For ease of access, many agencies use standard procurement contracts negotiated by Finance/Purchasing. In addition, the County uses WSCA and other state contracts to procure and obtain products and services at a volume discount. Discussed below are the processes related to hardware and software distribution.

Findings:
<ul style="list-style-type: none">– Standard processes are not in place.– Agencies may opt to handle distribution independently.– Software distribution is largely manual and inefficient.– Some standards/contracts are in place to support hardware distribution.

For the most part, hardware distribution involves procuring and installing desktops, laptops, and peripherals. Within ITS, purchases are made according to a standard procedure. The need must be justified and funded, and the request must be reviewed internally before being forwarded to purchasing. ITS uses six master contracts (Gateway, Dell, etc.) for supplying hardware. ITS’ standard server hardware is Compaq, and the laptop standard is Toshiba. Desktop purchasing goes out to bid. While in many cases there is no formal standard PC replacement schedule, lifetime of a machine at the County is generally reported to be three to five years. At the agency level, departments have the autonomy and flexibility to procure and deploy hardware as deemed necessary. There are limited standards in place to guide this process or to require cross-agency coordination where excess capability may be leveraged.

A similar acquisition process is in place for software. Distributed computing supports all of ITS and about 700 other County employees from other agencies (typically, smaller agencies without support staff). To the extent that standards exist at this level, they are ad hoc and for the most part undocumented. Software is primarily distributed in a manual format whereby technicians physically attend to each machine by loading applications with a floppy disk and/or CD. This is a time-consuming process and lacks control over how software is installed. ITS employs Microsoft’s Systems Management Server (SMS) to assist in the process to a limited extent. This tool may be used for centralized software deployment and inventorying, as well as remote control functionality for conducting troubleshooting activities and providing end-user assistance. Currently, the County is using this tool for some inventory functions and limited remote control capabilities, but is not using any of the SMS’ “software push” capabilities at this time. The software distribution process is generally initiated by a request submitted to the ITS help desk. The request is then escalated to the appropriate agency LAN administrator for closure.



ITS' Technology Operations section was intended to be a central point for licensing of software, but this has not been a standard practice because many agencies prefer to handle standard software updates independently. This independence has created a problem in that multiple software versions are deployed across the County. For example, the Transit desktops are running on various operating systems; including Windows 95, Windows 98, and Windows 2000, and there are different versions of Microsoft Office in use. This makes for logistical difficulties when trying to distribute upgrades to the various users on the network.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Technical staff have the know-how to strengthen distribution processes. ✓ Some master contracts are in use to supply hardware.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ Manually intensive processes are utilized around the County. ✓ Standard processes for distribution are largely missing. ✓ Various versions of the same software are in use throughout the County.

B4. Standard Operating Procedures (SOPs)

Standard operating procedures are formally defined and documented activities related to how operations, data, records, and maintenance will occur. SOPs are typically codified in manuals available to those who are involved with technology, including managers, technicians, and end-users. As with many other types of documentation, SOPs are largely missing at the County. Mainframes are an exception, as the de facto standards and procedures in place are largely up-to-date. Mainframe SOPs have been developed specifically to control application operations and modifications, and to support structured workflows and processes.

Findings:
<ul style="list-style-type: none"> – Standard operating procedures are largely missing. – Benefits can be obtained from creating and implementing Countywide SOPs for enterprise functions.

Another area in which efforts are underway to create and enforce SOPs is within GIS. Specific focus is on developing a detailed GIS Operating and Maintenance Manual (O&M) for all County GIS operations. It is expected that the GIS O&M plan for 2002, containing procedures, will be largely completed in the spring of 2002. Efforts will then focus on updating the document as a planning tool for 2003 budgeting and Countywide GIS implementation.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Mainframe documentation is fairly up-to-date. ✓ Substantial efforts are underway to create SOPs for GIS operations.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ SOPs around the County are mostly nonexistent. ✓ Agency personnel often do not recognize the benefits of conducting business in a standard manner.



B5. Maintenance/Upgrades

System maintenance includes preventative maintenance activities as well as repairs to address problems and computing malfunctions. Maintenance agreements exist in some cases, with major system vendors including for packaged software. Some contracts, such as with ESRI are centrally managed, while most others are

the responsibilities of the particular agencies involved. Many of the existing contracts are considered problematic by the County's lawyers and are regarded as generic and outdated. In addition, many contracts are month-to-month and are assumed to be more expensive than longer-term annual agreements. Overall, maintenance agreements typically have not been structured to provide adequate protection for the County.

Findings:
– There are few processes and tools in place to support hardware and software maintenance and upgrades.
– Standards are needed to help reduce the complexity of processes.
-- Maintenance and upgrade activities should be tied to an overall asset management function.

Maintaining software applications and hardware is challenging in terms of time and cost. Because many applications have been developed internally, they have not been routinely updated, in contrast to commercial off-the-shelf packages. Legacy systems are particularly problematic because the underlying code requires constant attention. From a hardware standpoint, most servers around the County are not under maintenance contracts and as a result receive only periodic attention. Likewise, PCs are not under contract, and network administrators take care of these machines on an as-needed basis. While maintenance is provided day in and day out, the overall scope of function requires increased management.

In contrast to maintenance, which is required to keep systems operational in a current state of functionality, upgrades are used to increase the level of functionality. Upgrades are needed and routine for many types of hardware and software. Servers are the primary types of equipment upgraded; PCs and other peripherals are maintained through an operating lifespan and then replaced. Agencies have the autonomy to upgrade systems as deemed necessary.

Because software upgrades are handled on a local basis, these efforts often lack coordination. Major packages are upgraded when agencies cannot wait any longer and have budgets to support the process (e.g., pending upgrades to PeopleSoft and IBIS). Perhaps the most significant upgrade area requiring attention, because of significant costs and productivity impact, is in the area of network operating systems and desktops. Because of the various versions of software and the number of servers and PCs operating, this area is very involved and typically requires central orchestration to be optimized. Slowly, some progress is being made in this area. There is now an enterprise agreement in place with Microsoft to assist in pending upgrades, and a centralized process for deployment has been defined. Utilizing this agreement for accessing software upgrades at a reduced cost will allow the County to realize savings over the two-year term of the agreement. Agencies may opt to use the agreement if they desire to obtain upgrades. Under this model, ITS will purchase the software and then distribute it to the agencies as needed. Agencies have indicated that they had a limited window of



opportunity for joining this agreement, and that the cost structure was not as cost-effective as hoped for in agencies that were upgrading existing licenses.

In addition to these software upgrade efforts, there are a limited number of equipment replacement programs in place for hardware. Agencies report that PC equipment is expected to operate over a three-to-five-year time frame and then be replaced as the need is perceived. Some agencies, such as Transit, have formal equipment replacement programs — PCs are replaced every four years, as are servers.

In general, until more resources are allocated to the upgrade function, comprehensive major benefits involved in asset management will not be realized. The upgrade function should be managed in tandem with maintenance.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ A centralized process for deploying software has been defined. ✓ ITS has negotiated an enterprise agreement with Microsoft to support the upgrade processes.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ Standards are sometimes developed but are not enforced. ✓ There is no enterprisewide solution in place for managing maintenance and upgrade processes. ✓ The County does not have formal programs established for sizing, selecting, and ordering equipment.

B6. Technical Security

Procedures that protect the confidentiality, integrity, and availability of County data from both external and internal threats are limited in scope. While there has been some movement toward decreasing the level of security exposure, no integrated plan has been developed. Technical security components include perimeter, remote and wide area network; network operations and access controls; virus protection; and management. Existing conditions in each of these areas are described below:

Findings:
<ul style="list-style-type: none"> – Some vulnerability exists to internal and external threats. – Firewall protection is not as robust as it should be to protect the WAN. – Limited enterprise security management is occurring.

Perimeter Security, Remote Connectivity, and the Wide Area Network— The perimeter security countermeasures taken to protect the County from Internet-based risk are deficient. While some of the shortcomings relate to the County’s inability to know if there has been a compromise, others relate to the lack of measures taken to protect the County from external threats. Specifically, there is no host-based or network-based intrusion detection system (IDS) in place, which means that the County does not currently have a way to look for and identify malicious activity on the organization’s network. Consequently, external and internal threats can attempt to access multiple times undetected, refining their efforts each time. This creates the potential for hackers to access King County’s systems and/or data, make changes to it, and/or use County systems to launch an attack on another organization.



The lack of an IDS is significant for three reasons. First, the County has a number of Microsoft IIS Web servers behind the firewall but not installed on “sacrificial networks” or DMZs. Because the Microsoft product is one of the most vulnerable hosts on the market, these servers should be placed on properly configured sacrificial networks, and traffic between these devices and the County LAN should be routed through a firewall. Second, management reports that the County’s perimeter may be inadequately secured with an excessive number of open ports. Because there is no record of authorized recent penetration scans, the effectiveness of the firewall to specific hacker attacks is untested. Third, with the lack of firewalls between subnets, a skilled and malicious user who has gained access to a single location on the WAN can attempt access to any host on the distributed network. Clearly, the lack of adequate perimeter security and a means for monitoring potentially malicious network traffic on the WAN should be remedied without delay.

Remote access is also a vulnerable area for the County. Significantly, while Microsoft Remote Access Services (RAS) is in use at the agency level, it is forbidden by earlier County policy. These “back doors” into the system may not be adequately monitored and audited. Also lacking is a centralized inventory of remote access users (with associated IP addresses and method of connection) that can be compared with actual user activity of remote access into the County. This inventory would enable tracking of usage and could be invaluable if an attack were to be identified. Like firewall design, there should be limited and monitored means of access into the network, and these access points should be centrally managed.

Network Operations and Access Controls — The County’s decentralized IT management model, large number of servers, and some 60 different domains make security of network operations and access challenging. For example, the Application Development and Systems Support (ADSS) group manages security for the external Web servers by installing patches, software, etc., to ensure there is adequate security in place at the agency level. However, if an agency opts not to have the ITS ADSS group manage their server, they are assigned to a different network segment and are responsible for their own updates, security, and support. This is not an effective solution because a single compromised Web server can act as a point of entry into the entire organization. Because different agencies are responsible for managing the security aspects of their own networked systems, and because there is no set of Countywide guidelines, the level of protection for particular servers and hosts is inconsistent. Also, current operations do not include methods for adequate logging of potentially harmful Internet or e-mail activity, governance over internal security controls, or internal intrusion detection.

Virus Protection — ITS has an adequate virus protection process. However, there is no uniform virus management method outside of ITS, and other agencies have varying levels of security in place. Some, such as Transit, report using ZenWorks to automatically push the latest version of McAfee to each client desktop with each network log-in. Again, the decentralized structure means that some network systems are more protected than others from the virus threat.



Management — Having a decentralized model for security makes governance over security concerns difficult. While there are members of the organization with a substantial interest in securing County assets, the lack of security policies, procedures, and management means that controls over the system are quite limited. Currently the parties who are responsible for particular segments of technology are also responsible for related security over data. For example, separate personnel are managing security for particular Web applications, servers, and the firewall. This approach is fragmented, with limited attention being paid to the enterprise. Further, no current comprehensive security plan is in place, nor is there a management process established to oversee the function.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Agencies have been conscientious about keeping both the desktop and e-mail virus protections up-to-date. ✓ Security is of considerable concern to key management. ✓ The County has a de facto policy on Web security. ✓ It appears that the County has not yet experienced a costly compromise of its systems.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ There are a variety of different desktop virus packages in use throughout the County making it difficult to have centralized monitoring and coordination. ✓ With multiple different technologies in use and the number of people involved, it is difficult to track and monitor exactly what protection exists. ✓ The geographic dispersion of the servers makes it difficult to maintain a security standard across the County. ✓ Perimeter security is weak. ✓ Intrusion detection and regular penetration testing are not standard practices. ✓ Security staffing and management oversight are limited. ✓ Security policies and plans are extremely limited. ✓ VPN and RAS are potential “back doors” and are not adequately monitored or controlled. ✓ The internal WAN is not secured through firewalled subnets.

B7. Systems Administration

Systems administration is an ongoing, day-to-day function as networks, servers, and workstations are actively operated and maintained. Administrative tasks include basic operations, light maintenance, and fine-tuning systems. The staff involved include system administrators at central sites and network administrators scattered throughout the County. Systems administration is currently provided at mixed levels. There is a general correlation between decentralized agencies and questionable administrative performance in terms of personnel assigned, available expertise, and resulting tasks being completed. The technologies that are being administered within the County and the manner in which administration occurs are discussed below.

Findings:
<ul style="list-style-type: none"> – Administration responsibilities are assigned to technicians throughout the County. – Decentralized administration begins to degrade as fewer people are involved. – System administration efforts include a centrally managed domain structure, as well as efforts underway at specific agencies. – More formal standards and guidelines are needed to support the efforts.



A key part of systems administration is provided centrally by ITS. The department staffs a data center 24 hours per day, 7 days per week. Services include mainframe operations and production control, data entry, and operating the after-hours help desk. The data center was established many years ago and is supported by 20 staff. Some of the data center's larger customers include the Assessor, Treasury, Payroll, and Elections Departments. The ITS data center is currently working to set criteria for equipment that can be stored on the data center floor. The intent of this determination is to create additional space, maximize its use, and provide overall cost savings for the County.

With regard to e-mail administration, current servers are operating on Microsoft NT 4.0. ITS owns and operates all of the e-mail servers and operations; mail services consist of four Exchange servers with approximately 3,000 mailboxes each. Four other servers perform different e-mail functions, including one server processing Internet e-mail, one spare server, one NetIQ server, and one LISTSERV server.

In addition to the central data center and e-mail, the network is also administered centrally by ITS. Although ITS has the authority to limit or consolidate log-on domains, some 60 different log-on domains have been established to date. To address the complex network administrative tasks that accompany having so many distinct domains, the County is in the planning stages of migrating to Windows 2000 with Active Directory. This will force a revised hierarchical domain structure to streamline and simplify systems administration. There has been some resistance to the creation of a single domain from agencies because of concerns about centralizing control over networks that are currently managed at the agency level. In an effort to collaborate with other agencies on this upgrade, technology government launched a Windows 2000 project team that includes representatives from the different agencies. This team-based approach is preferred in that it strives to foster cooperation across the agencies. As part of the Windows 2000 project, the County is planning to implement three domain controllers (downtown, Kent Justice Center, and King Street). DNRP has set up a simulation Windows 2000 Active Directory in the Microsoft lab to test the team's technical projections.

Decentralized data centers are also operated in conjunction with the support services provided by the various technical support staff employed. For example, DNRP operates four divisions, each with its own data center and support staff. In addition, technical support staff are assigned to operate the supervisory control systems at the wastewater treatment plants. In total, over 1,600 users are supported through the various DNRP data centers.

Hardware and software is administered on a decentralized basis all over the County. For example, numerous agencies have opted to administer their own servers partly because of concerns about ITS' high costs. Some agencies, including Transit, use a mix of resources to administer systems. While the majority of Transit's servers are located at South Jackson Street Center, others are scattered at various locations, including Key Tower and other transit bases. There are approximately 30 servers at all locations. Transit is considering reducing the number of remote servers from eight to two or three. The users of these servers would then access files and print resources over the WAN. All but one of Transit's LAN administrators are located at South Jackson Street.



<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ The County has formed a Windows 2000 migration team to work together on implementing a new domain structure. ✓ The County is working with Microsoft to ensure that a correct domain structure and a successful migration are planned. ✓ County mail services are consolidated in one location. ✓ Departments report that ITS provides good administrative technical support and that customer service has been acceptable and is improving. ✓ Maintenance administration occurs continuously as systems are maintained.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ Systems administration procedures and efforts vary from agency to agency. ✓ There is no "final" authority assigned over the County's network domain structure, or for other hardware and operating systems in general. ✓ Sixty-three different log-on domains cause confusion and difficulty in locating resources. With 63 domains, there are potential security and vulnerability issues.

B8. Documentation

Documentation falls into two categories, technical and end-user. From a technical standpoint, documentation has been developed in an ad hoc manner with much of it lacking. In general, the responsibility for documentation falls to those managers and lead individuals who feel it is important to produce. The County has no standards for documentation, nor a repository, nor an index of sources. Much of what is available is dated. In addition, the documentation that does exist is not well tracked. Additionally, existing technical documentation is not well disseminated to those who need access to it for instructional or support purposes. Personnel have little time to produce documentation, and the function appears to be a low priority for most agencies. Some adequate documentation exists in the areas of major applications, especially for those applications provided by third-party vendors.

End-user documentation is often in the same condition but is available in some agency environments. End-users are often not familiar with the availability of formal written instructions as a general source of support. Table 4 indicates the degree to which end-user documentation was reported to be available and complete by agencies participating in this study.

Findings:
<ul style="list-style-type: none"> – Few resources are made available/assigned to produce documentation. – This is a low risk but understated area of importance. – What exists is often out-of-date. – End-user and technical documentation both are limited in availability. – Documentation is not mandated as a requirement of development, implementation.



Table 4: User Documentation Availability

Agency	End-User Manuals Available	Relatively Complete
Information Resource Management		
Office of Human Resources Management		X
Adult and Juvenile Detention		
Natural Resources and Parks		
Judicial Administration	X	
Airport	X	X
District Court	X	X
Fleet Administration	X	X
Roads Services		
Metro Transit	X	X
Prosecutor		
Public Health	X	
Finance	X	X
Development and Environmental Services	X	X
Superior Court	X	X
Information and Administrative Services	X	
Sheriff's Office	X	X

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ There is an awareness within ITS and other agencies regarding the lack of documentation, particularly regarding SOPs. ✓ Numerous agencies have developed end-user manuals, with some being reasonably complete.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ No documentation standards exist across the County. ✓ Documentation is sporadic; where it exists, it is not necessarily complete or up-to-date. ✓ There is no documentation requirement for procedures, system configurations, agreements, etc.

B9. Telecommunications

The Voice Network group administers telephones Countywide, supporting 17,000 lines, cell phones, and pagers. Agency personnel notify this central group in ITS when phone service changes are needed. Currently, there is no telemanagement system or software in place to monitor directory assistance, long distance, etc. The Voice Network group is frequently asked to provide metrics in these areas, but none are available.

Findings:
<ul style="list-style-type: none"> – The County's voice communications services meet the basic requirements of users. – There are many elements of the existing legacy systems that can reliably deliver continued services. – There is a clear opportunity to exploit existing investments while migrating to a more fault-tolerant, reliable system that can deliver state-of-the-art technologies.



For vendor-supplied cell phones and pagers, the County uses state contracts managed by the Voice Network group. As part of the 2002 budget plan, there is a provision requiring the group to investigate contracts to make sure best value is being obtained. In an overall effort to stabilize the environment, ITS has issued a Request for Proposal to develop a three-to-five-year plan for migration to a more manageable system.

For basic phone services, County employees are served dial tone via Qwest-provided and -maintained Centrex services, supplying approximately 6,700 Centrex lines (DMS 100/Seattle 06), either direct to a desktop telephone set or through County-owned PBXs and key systems. Long-distance access is provided through the State of Washington SCAN network. The County's network of NEC, Fujitsu, Nortel PBXs, and key systems are connected to the Public Switched Telephone Network (PSTN) via leased services from local exchange carriers (Qwest and Verizon). With few exceptions, the voice-switching systems are disaggregated end points that allow inter-County office communications via the local exchange carrier switch only. These voice switches are not privately networked.

Overall, the County's voice-switching systems have evolved into a disaggregated collection of disparate, distributed systems without integration, network transport efficiency, or a capability to deliver contemporary applications. The distributed network is based upon three proprietary types of PBXs and multiple, limited-function key systems with autonomous interconnected voice mail systems. The disparate collection of systems prevents deployment of practical call detail recording, standardization of unified messaging, voice over IP (VoIP), or other advanced applications.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ Voice-switching services have been consistently reliable.✓ County employees are generally satisfied with their service.✓ Voice mail largely meets or exceeds manager expectations.✓ Basic voice mail features such as automated attendant and message-waiting indication are provided.✓ The County leverages from contracts at the State.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ There is a critical single point of failure, without redundancy at the Qwest Seattle 06 Central Office.✓ The multiple proprietary voice-switching systems are not integrated.✓ Multiple voice mail systems serve isolated work groups and do not support integration with other voice mail systems.✓ Unified messaging is not supported by existing systems.✓ The County has not set user standards for functions and features of voice services.



B10. E-Mail Services

The Countywide messaging system reaches virtually every County employee that has a computer with relative ease. ITS runs all electronic messaging in the County with Microsoft Exchange on NT 4.0 servers. There are eight Exchange servers: one for Internet e-mail, one spare server, one NetIQ server, one list server, and four exchange servers. Each Exchange server has an internal DLT drive (35/70 – 7000 drive) and is backed up with Veritas software (Backup Exec). Backups are completed independently using 70 GB tapes. The process typically takes over 12 hours. ITS maintains one week of Exchange backups on site for discovery purposes.

Findings:
<ul style="list-style-type: none">– Overall messaging in the County is provided at reasonable levels.– ITS is using industry-standard software for the messaging structure.– Highly trained staff provide training on a proactive basis.

The staff of seven messaging administrators have been effective in promoting mostly seamless usage of the e-mail system across the enterprise. Some capacity challenges exist in the system. For example, servers are currently handling over 3,200 accounts per server, which is stretching the performance capabilities of the existing system. E-mail storage is set at an unusually low storage capacity on a per-user basis, which results in a high level of support and maintenance requirements of user accounts. A Microsoft Technical Account Manager (TAM) is scheduled to conduct an assessment for converting to Exchange 2000, a component of which is a review of this storage limit. Rapid growth of messaging is currently the biggest challenge related to e-mail. The County relies heavily on e-mail communications; messaging support is recognized as a significant portion of help desk calls.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ E-mail services are consolidated at one location.✓ There is a strong e-mail structure in place with adequate support and training.✓ The County is taking proactive measures with Microsoft to manage the ITS e-mail backbone.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ A small user storage limit exists and does not fit all users' needs.

B11. Voice Messaging

Eighty percent of the County's voice mail is located on one aging server. The other voice mail is handled by other systems that are not integrated, thus impairing the level of communications that may exist. An example of such disintegration is an agency with employees in multiple locations who must manually dial different systems to leave messages for each other. Because the County's voice mail systems are separately integrated to serve voice-switching systems with proprietary interfaces, a user on one agency's voice mail system cannot be routinely assigned a mailbox on another agency's voice mail system and retain basic functionality. It is not possible to expand the central system and expect to have

Findings:
<ul style="list-style-type: none">– Basic messaging is generally available all around the County.– Systems lack integration, inhibiting effective communications.– A project has just recently begun to unify systems.



common basic features available to all mailbox users. In addition, the voice-messaging systems in place are unable to deliver state-of-the-art application solutions. Specifically, County systems do not support unified messaging functionality whereby desktop users with WAN access and e-mail would be able to communicate voice, data, fax, and video via e-mail. Until the County's voice-messaging systems design is addressed and changed, these capabilities will be generally unavailable, except on a fragmented basis.

- | | |
|--------------------|---------------------------------------------------------------------------|
| <i>Strengths:</i> | ✓ Basic messaging is generally available all around the County. |
| <i>Weaknesses:</i> | ✓ Systems lack integration, inhibiting effective communications. |
| | ✓ Primary voice mail server appears to be dated and has limited capacity. |

B12. Data Management

Over the years the County has spent limited resources in the area of data management. This is true for two main reasons: limited resource availability and the lack of planning and analysis. Work-to-date has focused on linking systems without the benefit of determining the best way to connect databases. In short, data management has occurred in piecemeal fashion, with products purchased and deployed, but with limited thought given to how data will be integrated or administered.

Findings:

- The County has lacked significant data management efforts over the years.
- Lack of attention in this area reflects decentralized County culture.
- Enterprise data management is in its infancy.
- Will be key to connecting users together for information-sharing purposes.

While some basic intra-agency data management has been provided for specialized systems, there has been little effort at the enterprise level to establish an overall design that will support the County. Significant data management needs on the enterprise level include connecting agencies' systems to provide required reports and to provide query capabilities. Items of particular importance include program, service, financial, and operational data to answer questions for the Council staff, Executive management, and Finance personnel, among others. Data management deserves more consideration because it is fundamental to supporting connectivity and integration, sharing of information, and increasing efficiency through elimination of redundant data handling and reporting activities. Components of data management include (1) enterprise planning, (2) data ownership and stewardship, (3) database administration, and (4) use of meta data. Each of these components is discussed further below.



a) *Enterprise Planning*

To establish proper Countywide data management, enterprise planning must occur to define data, processes, and relationships between data. With the exception of GIS, King County does not have any enterprise-level data plans, and few planning efforts are scheduled. When properly conducted, data management efforts can result in productivity increases and significant cost savings. Conversely, databases that are created without the benefit of up-front planning may interfere with the flow of business, increase costs, and, in the end, hinder the ability to delivery services. At present, and besides the area of GIS, planning is conducted only at the agency level and then typically only on a project-by-project basis.

b) *Data Ownership and Stewardship*

Aside from efforts underway with GIS, there are no Countywide data ownership and stewardship programs in place. Ownership and stewardship are distinct but related concepts. Data ownership consists of delineating responsibilities for determining what data are maintained, who can access and modify data, and enforcing rules over maintenance. Data ownership requires that every important data item has an owner. For the most part, data ownership has not been determined at the County. In contrast, stewardship is the task of properly managing data according to the rules specified by their owner. This includes ensuring that data are correctly entered, interpreted properly, and safeguarded from misuse, accidental loss, or theft. To varying degrees data stewardship also occurs within the agencies but not at the enterprise level.

When sufficiently managed, data ownership requires that data be recognized as an asset of the County and is separated from the systems that maintain the data. For example, the list of “County constituents” has a clear and established value for many purposes and is therefore a distinct asset, regardless of whether the data originate from voter registration, property tax billing, or creation of birth certificates. Data ownership occurs on a de facto basis because existing applications have natural owners in the agencies that first developed the functionality. Data that are used across agencies need to be recognized as County data, but still will require a specified responsible owner from a single agency. Ideally, the data owner will be responsible for defining how the data will be used by other agencies.

Transitioning the County to establish effective data ownership will be challenging. Agencies are not used to managing systems in this manner, especially across agency boundaries. Initial efforts have been made in the area of GIS, where the ownership model may be considered as a starting point for defining how data will be managed in the future. It is likely that agency personnel may resist sharing data until owners are assured that the data they manage will be protected and maintained as reliable.



c) *Database Administration*

Database administration occurs to some degree with all of the Oracle, SQL, Access, and other databases utilized at the County. Administration involves the maintenance that occurs related to maintaining control over the data model and related data. Database administration combines elements of ownership and stewardship. Rigorous database administration is required in especially robust environments such as those used in Oracle systems. In these environments, full-time personnel are assigned the responsibility of managing the data model and maintaining corresponding integrity.

Agencies employ database administrators (DBAs) for specific, usually large, database systems. For example, GIS has a DBA assigned to administer the Oracle and SQL server systems that are located in the center. Likewise, Finance employs three DBAs to administer Oracle-based systems. Even the larger, older systems require database administration, as is the case for Adabas systems running on the mainframe, which requires a little over one FTE to manage the data. How the different systems are administered is dependent on the various configurations and procedures established.

d) *Meta Data*

County personnel report that no formal meta data program exists. Meta data are data that define other types of information. Meta data fall into two categories: information that defines and explains data, and information about where and how to get information. This information is typically found in a DBMS system management or in program documentation. In the survey conducted for this assessment, County TMB members specified that information (where and how to find information, who owns it, what it is about) is considered to be a highly valued asset but is undermanaged. The issue of meta data has been addressed as part of GIS management but is lacking elsewhere.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ Basic information is available from the catalogs of existing DBMS systems.✓ There is a strong demand from County staff for information about where and how to locate data.✓ The central GIS program provides access via the Web to County GIS data.✓ County staff are generally aware of the potential to be gained through data planning.✓ Within agencies, system users maintain control of the data they use, providing de facto responsibility for data ownership.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ There is no Countywide data planning occurring outside of certain agencies, particularly GIS.✓ There is a lack of awareness of the concept of data ownership and stewardship.✓ No responsibility is established for maintaining the correctness or security of County-shared data, except within the individual systems.✓ Without standards and a business-oriented data model, meta data are hard to obtain.✓ Meta data are not being kept current.



B13. Capacity Monitoring, Backup, and Restoration

Capacity of the County's servers and other storage mechanisms (tapes, etc.) directly impacts systems efficiency, especially if there is insufficient storage and processing space to support the processing of critical applications. Similarly, the related functions of backing up and being able to reliably restore data are vital to ensure the ongoing functionality and usefulness of County systems. Each of these components — capacity, backup, and restoration are discussed below.

Findings:
<ul style="list-style-type: none">– Usage and storage capacity are not actively monitored for optimum use of network storage resources.– Backup tools are sufficient for the County's needs.– Proven technologies are in place to ensure adequate and reliable backups. However, policies and procedures are needed to ensure assignment of responsibilities.

With regard to managing capacity, servers appear to be key assets that are undermanaged. The County employs the use of a software tool (NetIQ) to monitor servers; however, management activities have been limited because of the prevailing attitude that it is less expensive to add disk space rather than pay for the labor to monitor systems. In general, when a server runs low on disk space, another drive is added. Quota Manager was deployed previously in ITS, but its use was aborted because of end-user concerns around inflexible limits on storage space allocated per user. At the agency level, there has been interest in using Network Attached Storage (NAS) or a Storage Area Network (SAN) for managing disk space.

From a physical facilities standpoint, many of the County's servers are located in the data center at Key Tower. The space is used efficiently, and there do not appear to be any space constraints. Space is also not likely to become a problem over the next several years, and even with more servers hosted, the total number of servers could be reduced by more efficient management over system storage capacity.

A number of software packages are actively utilized throughout the County to perform system backups. These include Tivoli, Veritas Backup Exec, TSM, Legato, and NT Backup. With the exception of the NT Backup program, these tools are generally robust and sufficient to meet County needs. The County uses Tivoli Storage for backup and restoration of LAN servers and the mainframe. Tivoli performs a combination of comprehensive and incremental backups. Administrators receive an e-mail from Tivoli if a backup has failed. The mainframe group backs up other servers and workstations by request only. Veritas Backup Exec is also used to backup the Exchange servers. Exchange server backup is typically scheduled nightly but takes over 12 hours. Tape storage for the data center is located in the Key Tower. As backups are completed, tapes are also rotated off site. ITS also backs up PCs and servers for agencies physically detached from the Key Tower. Tapes are stored off site by an external vendor, Iron Mountain.



Besides centralized system backup, agencies are also managing backup processes at their own locations. Most agencies report that backups are conducted regularly. However, there are no standard operating procedures in place to guide agency efforts. Agency processes vary in terms of the types of backups conducted, off-site storage, and test procedures related to restoration. Numerous agencies surveyed report a high incidence of backup failures. Key issues and challenges that were reported include the following:

- Backups exceeding tape capability
- Need for off-site storage
- High costs of off-site storage
- Need for adequate, enforced retention periods

Backup and retention schedules reported by each agency are noted in Table 5.

Table 5: Backup Processes

Agency	Regular Backups	Retention
Department of Assessments	X	Varies
District Court		Not reported
Council	X	24 months
Natural Resources and Parks	X	Varies: 3–6 months
Judicial Administration	X	Varies: 6 months +
OHRM/OCR	X	24 months
Prosecuting Attorney's Office	X	Not reported
Road Services	X	Varies: 3–6 months
Metro Transit	X	Varies: up to 10 years
Public Health	X	3 months
Finance		4 weeks
Fleet Administration	X	2 months
Public Defense		12 months
Adult and Juvenile Detention	X	3 months (minimum)
Superior Court	X	1 month
Airport	X	Not reported
Sheriff's Office	X	3 months
KCGIS	X	Up to 12 months

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Sophisticated backup is occurring for the mainframe and NT servers. ✓ The County has some experience with software that helps optimize disk space (Quota Manager, etc.). ✓ Facilities have capacity to handle reasonable expansion.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ Numerous agencies report a high incidence of backup failure. ✓ Capacity management is not occurring at sufficient levels, especially related to servers. ✓ No standards are in place for data retention. ✓ Exchange backups are stored on site. ✓ Restore testing is not systematized.



C. Architecture

Architecture is the framework and set of guidelines to direct the process of acquiring, building, modifying, and integrating IT components throughout the enterprise. The components include equipment, software, communications, methodologies, and tools. The County's architecture is considered to be the area in which most of the major strategic technology challenges reside. Strategic issues were found related to standards, processes and procedures, systems, deployment, and design. Weaknesses of particular concern include the following:

- Lack of standardized infrastructure, hardware, and applications software
- Lack of standardized Web-based technology
- Lack of uniform technical approach when integrating applications
- Heavily customized software applications that are challenging to maintain
- Continuing proliferation of servers without consideration of capacity or placement
- Lack of design, plans, and related agreements around the deployment of broadband to achieve convergence and disintegrated telephony systems
- Lack of best practices supporting enterprise data management
- Disaggregated and nonstandard workflow between agencies, as seen in Procurement, Human Resource/Payroll, Finance/Accounting, and within Law, Safety, and Justice functions
- Dual Financial and HR/Payroll systems being operated

Related to Architecture, additional discussion in this assessment is also found in Operations under Technical Security, Telecommunication, E-Mail Services, Voice Messaging, Data Management, and Capacity Monitoring.

C1. Mainframe

The IBM mainframe is physically housed at the data center on the 24th floor of Key Tower. The current architecture includes an OS 390 running at 55 MIPS with 1 GB of RAM. The system was recently upgraded and has significant capacity to grow to handle 20 to 30 percent more users and applications as requirements demand. The system supports several thousand end users presently. The County's most significant legacy applications run on the mainframe, including Public Health, Financial (ARMS and MSA), and Law, Safety, and Justice applications. The mainframe supports over 80 applications, most of which were written to meet the unique needs of the County.

Findings:
– Dated architecture, but few near-term operational implications.
– Needed to operate Public Health, ARMS systems, etc.
– Concerns about mainframe viability relate to economies of the platform.

While dated, the mainframe still produces for the County. A bottom-line issue is that the mainframe provides a computing platform that is essential for the present applications that are written to run on it. Because the software is vital to support agencies' existing operations, so is the mainframe. And as long as needs are met cost-effectively, it is mostly irrelevant in the near term that the architecture is decades old.



Concerns about mainframe viability also relate to the economies of the platform. This issue is not technical. Agency systems are naturally migrating to run on newer types of architecture, including client-server and the Web. If agencies start migrating their applications from the platform, it will be increasingly difficult for the remaining agencies to afford to run on the platform unless new applications or uses are found.

King County hired a consultant to conduct a mainframe study in 2000. The purpose of the study was to evaluate the current mainframe environment and the functions it currently performs relative to the technology direction planned by the County. The assessment provided the following findings:

- The mainframe runs reliably, but does not offer modern features such as relational databases.
- Investment in the mainframe has been reactive rather than on a planned basis.
- There are well-established procedures for mainframe operations.
- There is a lack of integration between mainframe and distributed systems resulting in redundant data entry.
- The mainframe code was developed decades ago and relies on senior programmers who are nearing retirement.
- Reports are difficult to customize because they require a programming request.
- Delivery of reports is not timely because they are usually scheduled to run overnight. Users have become accustomed to printing non-mainframe reports at their local printer and receiving the reports immediately.
- Character-based screens are cryptically coded and difficult to learn and use.
- Applications are out of date. They follow the business rules when they were developed and have not always been changed to meet changing business needs.
- Support staffing is stretched thin across many applications without adequate documentation.

King County also operates Prime Computers. The Prime Computers are operating applications for the Transportation Department and are retaining Payroll history information for Finance. Two application examples are Base Operations Support System (BOSS) that assigns work to 2,000 bus drivers every day; and Customer Assistance Tracking System (CATS) that manages complaints and commendations. The Prime Computer manufacturer is out of business and King County contracts with a third-party vendor for hardware support. The systems are planned for migration to another platform.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ Hardware and operating systems are solid.✓ Mainframe has been recently upgraded with capacity to handle growth.✓ Mainframe runs a lot of current applications economically.✓ Applications on the Prime Computers are planned for migration.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Architecture is dated.✓ Newer applications are being written for other computing environments, impacting platform utilization.✓ Prime Computers are obsolete.



C2. Network

The County's network is composed of numerous components including core infrastructure, transport architecture, I-NET, and cabling. The County's wide area network (WAN) comprises over eighty sites in a multiple hub and spoke topology based on a fiber backbone. Each of these components is discussed below.

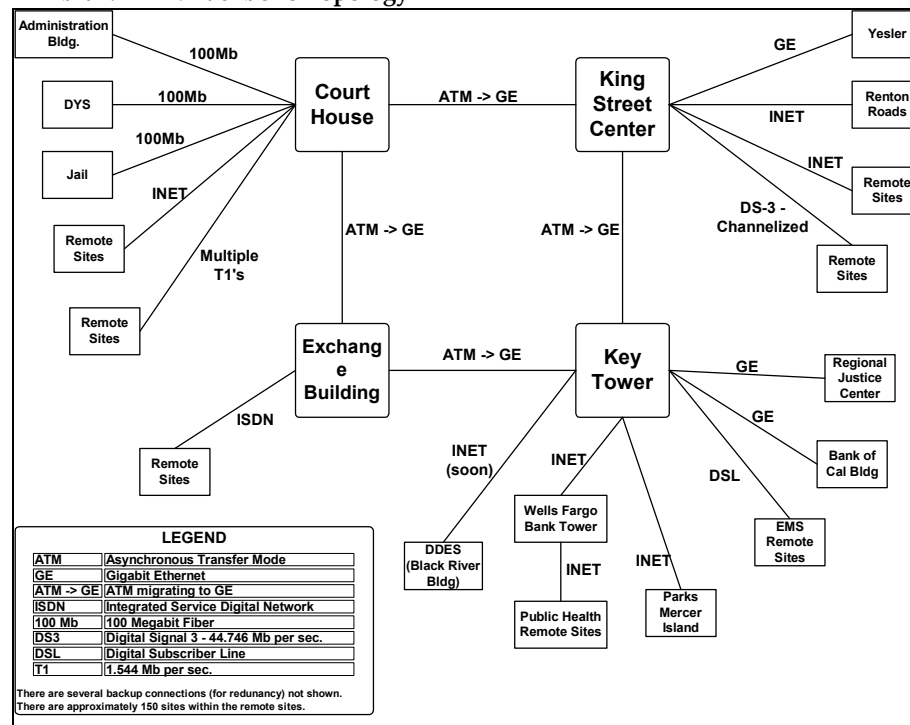
a) Infrastructure

The County's network is a type of hybrid composed of both Windows NT-based domains and Novell Netware 4.11 and 5.1 NDS networks. Core network electronics utilize Cisco equipment; however, other non-Cisco switches and routers are also utilized around the County. Few standards exist in the area of active electronic components (hubs, routers, switches, etc.). This is due, in part, to the broad diversity of applications in use and the timeframes over which different departments have implemented the architecture. Lack of centralized coordination of network infrastructure has resulted in duplicate circuits following the same physical and logical path. This redundancy is unnecessary and unplanned and results in increased costs for the County. The lifecycle of network equipment ranges from four to seven years, depending on the type of equipment used, level of support, and customer needs. In addition, staff have limited Cisco training, which impairs capabilities to design, install, and support the WAN. Existing WAN infrastructure is depicted in Exhibit 1.

Findings:

- Architecture is dated, but there are few near-term operational implications.
- The network is not completely uniform and as a result, requires additional support.
- The County WAN is not routinely monitored or maintained.
- Network support and maintenance are more complex and less efficient than would be the case if standards existed.

Exhibit 1: WAN Backbone Topology





The WAN is connected via an Asynchronous Transfer Mode (ATM) backbone. The County's network accommodates multiple media types including data, voice, and video. Because of the architecture, ATM has the capability to run from 45 Mbps using a DS3 to 2.5 Gbps using an OC-48. While the I-NET network will operate as an ATM-based WAN, the County's independent WAN is slowly moving from ATM to gigabit Ethernet as needs require and budgets allow.

The network's backbone has a physical-layer redundancy in most areas, as well as dual processors and power supplies in the electronics. Redundancy exists between sites, not between agencies. A primary shortcoming of the WAN is its limited delivery area. The core emphasis is on the downtown Seattle area, and costs associated with expansion grow dramatically in proportion to the distance from downtown.

WAN performance and utilization are being monitored by an external vendor, Network Health. Real-time tools are used to diagnose problems as needed. Additional tools for monitoring and managing the WAN are used at other critical points on the network. These include HP OpenView and NetScout. Monitoring efforts appear to be largely reactive in nature. Any testing/monitoring activity is conducted on request and not on a scheduled, continuous basis. In general, ITS is responsible for managing the WAN infrastructure and cabling from the servers to the desktop. With the exception of Transit, each agency maintains the switches, routers, and CSU firmware. These are updated using a variety of methods, including CWSI2000 and Telnet.

b) Transport Architecture

The King County WAN transport mechanism is largely outsourced. The County's network transport is primarily conducted through leased circuits obtained from local exchange carriers. Some DSL is also deployed under a contract with Covad. In addition, the County owns a number of fiber links that are used for transport, primarily in the downtown Seattle area. The primary hub for the County's WAN is located in the Key Tower, with end nodes at the Exchange, King Street, King County Courthouse (includes administration and the jail), Yesler, DYS, and the Regional Justice Center in Kent. A need also exists to connect to the Bank of California building and the Columbia Tower. Cisco LS 1010 ATM devices currently support these points; however, a migration plan is in place to install Cisco 55/65xx equipment for higher-speed gigabit Ethernet deployment.

c) I-NET

The County has established ownership of I-NET from AT&T Broadband, and it was scheduled to be turned over to King County as of December 31, 2001. I-NET is a layer of three routing networks based on fiber and Marconi ATM switches. There are 70 I-NET nodes, with 288 planned on the County-owned fiber. Six primary nodes are colocated at AT&T Broadband. Marconi is contracted by the County to provide maintenance and repair on the ATM switches at the nodes. The conveyance of information between the Marconi devices is based on a series of light pulses that is



virtually tamperproof in that the fiber would have to be “opened” to intercept the light. In doing so, the circuit would drop and an alarm condition would likely result. Key benefits of I-NET will be high speed and the ability to contain or reduce communication costs for the County and other public agencies served by I-NET. The County’s plan for implementing this network is under development. The plan is updated based on AT&T’s progress at cabling sites. In addition, there are some initial plans for targeting I-NET for voice transmission. The Library is anticipated to be the first in this regard. Most of the fiber in place is not currently being used. This network has significant potential to bring together data, voice, and video onto one-gigabit Ethernet-based transport mechanism.

The I-NET provides an excellent foundation for establishing a consolidated County WAN. This utility can be used to support a wide variety of applications that currently use either services provided by Central Office (Telco) or leased lines from the local exchange carrier (LEC), or a competitive local exchange carrier (CLEC). The fiber-based construction of the I-NET provides a level of physical security and integrity not available in copper-based systems. Given the infant nature of I-NET operations, the County has very little infrastructure (people, know-how, operations center) in place to take advantage of this convergence opportunity in the near term. Paramount to the successful operation of I-NET is a pool of qualified staff trained with and in possession of the necessary tools to efficiently manage the resource. I-NET requires a “constant vigil” related to its performance and utilization. At a minimum, I-NET management considerations should include the following:

- Seven by twenty-four passive monitoring of traffic on all segments of the I-NET. Performance standards need to be defined and then monitored with special attention to utilization of bandwidth. This should be accomplished using standards-based software that captures critical information pertaining to usage, to be used in troubleshooting and repair. I-NET staff will eventually be required to interpret this data and make changes related to equipment and software (enhancements or replacement).
- Scheduled preventative maintenance on all key components. This may require an inventory and possible adjustment of core equipment to ensure (n+1) redundancy that supports such preventative maintenance.
- Constant attention by either dedicated County staff or a qualified outsourced vendor.
- Written service-level agreements with support organizations (AT&T) covering access to facilities where I-NET equipment is housed. This agreement must address space, power, environmental, and downtime issues with clearly delineated responsibilities and specific restoration criteria.

There have been reports of past and ongoing problems with I-NET. Managers report that past “go-live” schedules have not been met. This has created problems for GIS, which has plans to rely on I-NET for enhanced data application delivery for some County sites and outside regional agencies. In some cases, outside agencies including the cities of Bellevue, Kirkland, Redmond, Renton, Issaquah, and Mercer Island have expressed concern about the County’s ability to put I-NET into operation.



d) *Cabling*

There are no agreed upon enterprisewide cable and infrastructure standards established at the County. As a result, there is a wide variety of cable installed, including category 3, 4, 5, 5e, as well as fiber and coax. Some of the more recent cable installations have been done well; however, others have not conformed to industry standards. Survey responses indicate that some poor system performance is attributed to cable, especially to “over length” segments.

Several of the interviewed IT staff appreciate the need for a set of standards governing the design, procurement, and installation of structured cable. However, current practice allows for requirements to be set on a “project-by-project” basis with no central control.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ The County maintains a robust WAN backbone. ✓ The County WAN uses proven technology and, for the most part, leases circuits from tier-one providers who maintain a well-staffed Network Operation Centers (NOC) on a seven-day-a-week, twenty-four-hour-a-day basis. ✓ Uptime typically exceeds 99.9 percent measured over a calendar year. Contracts with providers assure known operating costs for budget purposes. ✓ I-NET provides a carrier-class network delivery mechanism. ✓ The I-NET infrastructure provides network access across a wide segment of King County. ✓ I-NET is a secure private transport medium.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ Delivery area for the WAN is limited. ✓ Bandwidth on T1 circuits is fixed and not easily upgradeable. ✓ Lack of centralized coordination of network infrastructure has resulted in unnecessary redundancy. ✓ The County has few certified Cisco data communications staff. ✓ There is limited network-side monitoring of I-NET transport equipment. ✓ Few standards exist in the area of active electronics (hubs, routers, switches). ✓ WAN monitoring is reactive. ✓ No agreed cable standards have been established.

C3. Internet, Intranet, and Extranet

The County has been analyzing and implementing Web-based technologies for the past several years. As in many technical areas, however, it has been following — not leading — the market. The focus of development has been on providing one-way information to the public, internal users, and business partners. This low-risk approach has made a broad array of useful information available in three distinct areas

of Web utilization: the Internet, intranet, and extranet. The Internet is being utilized to communicate with the general public. The limited intranet is focusing on information

Findings:
<ul style="list-style-type: none"> – In general, agencies are slowly recognizing the potential of the Internet. – Development activity is limited by the resource constraints of the individual agencies. – The County has made initial steps to define e-government. – Government-to-consumer applications seem to be the current emphasis of the County’s e-commerce efforts.



pages and Web-enabled applications for employees. Most of the focus to date has been on providing information to the public. Just recently the County has been seeing more activity in Web development and utilization. Most of this activity is being driven by individual agencies. Particularly lacking have been advances related to conducting business and two-way transactions over the Web.

The current state of Web deployment is in the early phases of adoption at the County. Over time, County capabilities are evolving in a natural manner, increasingly becoming more sophisticated and interactive as the County progresses through the stages of Internet adoption, moving from displaying static content to supporting user queries, information submission, and two-way dynamic communication.

The County is currently using Web technology in a variety of ways. The functions reportedly being addressed now using the Web are illustrated in Table 6. In addition, KCGIS provides Web-mapping capabilities for most of the agencies noted and uses the Web itself for many of the functions listed.

Table 6: Web Utilization by Agency

		OIRM	OHRM	Adult and Juvenile Detention	Natural Resources	Judicial Administration
Current Web Functions	Research	Y	Y	Y	Y	Y
	Posting/distributing information		Y	Y	Y	Y
	Purchasing		Y	Y	Y	
	Soliciting feedback		Y	Y	Y	
	Internal information sharing	Y	Y	Y	Y	
	Telecommuting (e-mail, etc.)	Y	Y	Y	Y	Y
	Collaborative document use		Y	Y		
	Online purchasing		Y	Y	Y	
	Posting procurement data					
	Other online commerce			Y		
	E-mail	Y	Y	Y	Y	Y
		Airport	District Court	Fleet Administration	Road Services	Metro Transit
Current Web Functions	Research	Y	Y	Y	Y	Y
	Posting/distributing information		Y	Y	Y	Y
	Purchasing			Y	Y	
	Soliciting feedback		Y		Y	Y
	Internal information sharing				Y	Y
	Telecommuting (e-mail, etc.)	Y	Y	Y	Y	Y
	Collaborative document use				Y	Y
	Online purchasing			Y		Y
	Posting procurement data			Y	Y	Y
	Other online commerce				Y	Y
	E-mail	Y	Y	Y	Y	Y



		Prosecutor	Public Health	Finance	DDES	DIAS
Current Web Functions	Research	Y	Y	Y	Y	Y
	Posting/distributing information	Y	Y	Y	Y	Y
	Purchasing			Y		
	Soliciting feedback		Y	Y	Y	Y
	Internal information sharing	Y		Y		Y
	Telecommuting (e-mail, etc.)	Y	Y	Y		Y
	Collaborative document use					
	Online purchasing			Y	Y	
	Posting procurement data			Y		
	Other online commerce		Y	Y		
	E-mail	Y	Y	Y	Y	Y
		Sheriff	Superior Court	KCGIS	Assessor	
Current Web Functions	Research	Y	Y			
	Posting/distributing information	Y	Y		Y	
	Purchasing					
	Soliciting feedback		Y		Y	
	Internal information sharing	Y	Y		Y	
	Telecommuting (e-mail, etc.)	Y	Y		Y	
	Collaborative document use	Y	Y			
	Online purchasing					
	Posting procurement data					
	Other online commerce		Y			
	E-mail	Y	Y		Y	

The County has articulated the following vision for deploying e-government: “digital government, where residents interact with King County online, not waiting in line.” While as of yet there are limited goals and objectives established to meet this vision, some agency departments are making progress on their own in development. Several departments have embarked on projects to make more information available to the public via the Internet. For example, the Department of Assessments is working to publish certain “property/account” information on the Internet for access by the general public and taxpayers. Similarly, GIS data are currently extracted and made available to an intranet GIS system (KingView) that was developed in house and is available to the public at the assessment public information office. Through this system, parcel maps and assessment and taxation information are on the County’s Web site, as maintained by County GIS personnel.



In an effort to make further progress with e-government, the County has developed a three-phased approach to planning the implementation of enterprise wide e-commerce services for the public that includes an e-commerce evaluation, establishment of a pilot program, and then development of an implementation plan. The first phase is being addressed by a project to evaluate whether the County can use the State of Washington's infrastructure, tools, and policies for pilot projects. This includes exploring the potential for utilizing the electronic payments shared Web-hosting environment of the State's Department of Information Services (DIS). A simple application has been built for evaluation purposes to provide the County with some hands-on e-commerce experience in the shared hosting environment. Relevant components of the County's Internet, intranet, and extranet are discussed further below.

a) *Internet*

The County's public Internet site presents a broad array of information to the public. Most of the information posted to the County's public Internet pages is in the form of static HTML content. This constitutes roughly 80 to 90 percent of what exists on the County's Internet site currently. Approximately 8 percent of the Internet content is supported by a dynamic back-end database allowing user-directed searches. At present, the site is rather limited relative to the potential range of services that could be provided via that mechanism. The type of information/functionality currently provided on the County site includes the following:

- Static information
- News/updates/press releases
- Links to other Web resources
- Documents and forms to download or print
- Ability to send comments or suggestions directly to agencies
- Special sites for weather and other emergencies
- Ability to register for e-mail notification of specific types of events (e.g., road closures)
- Query facilities to several special-purpose databases
- A few business areas that permit online submission of information or requests
- Several GIS-based applications
- Vital records and bus passes for purchase electronically

While the public Internet site presents a vast array of information, it is limited in terms of the services that are accessible through this mechanism. The County's Internet site has also undergone usability testing to assess the value of the site. The ITS SPG Web Group conducted a study in conjunction with an external consulting firm, Usercentric Design, LLC. As part of testing, participants representing various stakeholder audiences completed 20 different tasks using one of three home page designs, and then provided feedback and recommendations regarding their preferences. Suggestions for improvements included providing clearer access to services, establishing a more robust back-end database for application support, providing better information in the services section, developing more integrated digital government applications focusing on the needs of the public and other



customers, creating more e-commerce applications, and establishing a secure authentication method.

b) *Intranet*

Significant effort has been focused on developing King County's intranet capabilities. The intranet is the set of information pages and Web-enabled (browser-based) applications that are used by County employees. The intranet is being partitioned by agencies into specific areas providing access to select information pages, applications, and data. There is substantial planning as well as actual development activity with respect to the Web-enabling applications that are used by County employees for conducting day-to-day business. In this process there has been a recognized shift away from client-server to browser-based applications. For example, projects are underway at the Sheriff's Office, DDES, Roads Services, and LS&J to expand the intranet capabilities. Overall, there appears to be more activity regarding the intranet than in the development of the County's Internet site.

Several agencies are in the planning or early stages of specification development for establishing intranet portals. The growing public demand for services and information creates a number of opportunities and alternatives worth considering. Specifically, there is potential for consolidation of intranet development efforts to prevent redundancy and unnecessary costs, and there are already commercially available solutions that may provide an alternative to developing portals in-house. Potential Web portal efforts that have been discussed to date are noted in Table 7.

Table 7: Potential Portal Functions

Agency/Department	Function
Office of Human Resources Management	Employee portal for open enrollment
Sheriff's Office	Extranet functions: <ul style="list-style-type: none"> • Crime bulletins • Case report data
Public Health	Clinic data sharing
Community Health	Online postings, information, and document sharing with providers

c) *Extranet*

The County extranet is a place to facilitate County business. The extranet is a set of information pages and Web-enabled application interfaces established for specific external groups for the purpose of collaboration or conducting business. This study was unable to ascertain the level of extranet activity at the County. As with the Intranet, the extranet can be partitioned to provide selected information pages, applications, and data for particular sets of users. There is a growing awareness within County agencies of the potential of providing special access to conduct business via an extranet capability.



<i>Strengths:</i>	<ul style="list-style-type: none">✓ At present, there are County applications that have been developed in each of these three distinct areas: Internet, intranet, and extranets.✓ The County is building internal knowledge and skills that can be leveraged for future deployment efforts✓ The current Internet site presents a broad array of information content, including basic information, news, contact information, etc.✓ The Internet site has a consistent look and feel.✓ The County has an formal plan to expand use of e-commerce.✓ Department-level efforts are increasing, with nearly every agency utilizing Web technology and improving business processes.✓ ITS staff are knowledgeable and offer classes on HTML and Web standards.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Current emphasis is mostly limited to static “public information” rather than interactive “public services.”✓ Existing applications are largely the result of efforts by individual agencies, not cross-agency teams.✓ Mainframe data structures and system architecture do not provide an efficient way to publish “real-time” data to the Internet.✓ The County is behind some of its peers in implementing and realizing the benefits of e-commerce.✓ The County intranet is expanding in a relatively unmanaged manner.✓ Little work has been done on the extranet with respect to infrastructure development.✓ The ITS Web team has a long list of potential projects in the queue but limited resources to support development.

C4. Personal Computers

The 10,000 workstations in operation around the County range from brand new machines to dated, underperforming models. The County utilizes workstations from the most prominent vendors, including Dell, Gateway, Toshiba, Micron, and Compaq. There are also a large number of PC clones from an assortment of local

vendors, including Cascade, Master Computer, and Right Systems. The workstation inventory equates to a roughly \$10 million investment.

Findings:
<ul style="list-style-type: none">– Total investment in systems amounts to over \$10 million.– As a result of the variety of machines in use, many personnel utilize different versions of software.– It is estimated that approximately one-third of the current machines require replacement.

Disparity and inconsistency characterize the current status of the workstation program. The agencies that are able to fund their own technology advances tend to have more updated machines, while smaller, often general funded, agencies have dated hardware and software. There is no uniform Countywide process to replace, update, or maintain this infrastructure. As a result, approximately 3,000 machines are considered to be underperforming, which hampers the response time of these machines, presents barriers to running up-to-date software, and creates a disparity among “haves” and “have-nots.”



There is no comprehensive up-to-date inventory of workstations at the County. And where agencies track these assets, there is little conformity regarding the detail tracked. Some units reliably track detailed system information, date of purchase, and operating systems, while others simply list the workstations with no associated information. There are currently no County standards for workstation hardware, or replacement and maintenance. Processor speeds and manufacturers, RAM allotments, storage capacity, and hardware configuration all vary considerably from one agency to the next.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Some better-funded individual agencies have PC replacement programs. ✓ Two-thirds of the machines are reasonably current in terms of performance.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ Some equipment, much of which is located in smaller agencies, is dated. ✓ No formal enterprisewide replacement program is in place. ✓ Funding problems exist to support replacement. ✓ Workstation tracking is inconsistent. ✓ No formal standards exist.

C5. Integration

Systems across the County have been developed over many years and have focused on narrowly defined functionality intended for particular uses, mostly within specific agencies. Because applications have been developed for a specific use, the same systems have not usually been designed to integrate with others. When integration has

been established, it has been done through the use of direct connections, middleware, or data warehouses. While many specialized applications do not require integration with other business areas, the County often lacks integration in areas in which it is needed. Integration is needed at an enterprise level for applications that are used across the County, and sometimes within related business functions. Needs in the enterprise arena exist in Finance, Human Resources and Payroll, GIS, and Document Management (DM). An example of needed integration at the business-function level is in the area of Law, Safety, and Justice, where the Sheriff's Office, Prosecutor, Courts, and Jail require automated links to align workflow and thus increase efficiencies and promote better utilization of resources.

In general, there is little intra- and interagency integration between applications. For a large organization such as King County to work effectively, related agencies need to work in a cooperative manner to leverage each other's efforts and to achieve smooth workflow between them. The County processes cannot work effectively unless the computer systems that support them also interact in a coordinated manner. In the current environment, significant resources are devoted to reentering data redundantly into the County's nonintegrated systems. Then, all too often, the data require further reconciliation to ensure that data integrity is maintained and consistently reported. With the effort devoted to maintaining disparate systems, the County misses opportunities for operating more efficient systems.

Findings:
<ul style="list-style-type: none"> – The County lacks a standard set of specific products and approaches to achieve integration. – Present integration is achieved through the use of direct connections, middleware, and warehousing. – There is a limited amount of intra- and interagency integration.



Depending on the processes being addressed, different levels of integration are available for the County to use. The different levels are shown in Table 8.

Table 8: Integration Levels

Type	Description	Sample Technologies	Representative Products
1. Point-to-point file transfer	Periodic sending of entire file between two systems	FTP, e-mail, mainframe utilities, ETL tools	Operating system vendor tools
2. Hub data mart	Validated data posted to sharable hub for approved users to access	Extract-Transform-Load (ETL) tools	Ascential DataStage Informatica Software AG EntireX
3. Asynchronous messaging	Message stored until receiver calls for it	Message-Oriented Middleware (MOM)	MQ Series
4. Synchronous access	Program-to-program communication via API.	Com, CORBA, J2EE, CICS	Vitria, Tibco, CICS
5. Shared database access	Applications directly access the same data; immediate and complete	SQL queries, heterogeneous DB query middleware	Native SQL, ODBC/J.D.BC, IBI, Nimble Technologies

In responding to the technology inventory for this study, County agencies identified the handling of redundant data as a primary problem with their systems. Redundancy of data is not in itself a problem if the redundancy is managed carefully. However, many business units do not manage data as well as they should. Often changes are made in some systems but not in others, and as a result, records are added or removed in an uncontrolled manner. Under these circumstances, data quickly become unsynchronized and the users lose trust in the underlying systems. Redundancy is most inefficient from the user standpoint because staff are forced to hand-enter the same information multiple times and often in different formats.

During the planning study, it became clear that management is aware of the importance of data sharing. Numerous data integration needs were identified during the survey process. The results are shown in Table 9, identifying the data types that technical managers consider as being the most important to maintain. The data types are ranked in order of priority.



Table 9: Important Data Types Needed for Integration

Score	Data Type	Description
96	Information	Where and how to find information, who owns it, what it is
83	Account/Budget	Financial accounts and their associated balances and budgets
78	Service	A service provided by the County to its constituents and partners
77	Law/Regulation	Laws and rules related to the County
73	Project	A County project that uses people, equipment, money, etc.
70	Employee	A person who works for the County (salaried, contract, or other)
61	Legal Subject	A person of interest to County Law and Justice functions
57	Partner	Business or government agency that deals with the County
55	Facility	County buildings, roads, compounds, etc.
53	Parcel	A parcel of land in the County
52	Equipment	Devices, vehicles, computers, etc., managed by the County
37	Constituent	A person who is a recipient of County services

The survey respondents also identified a number of impediments to integration, data sharing, and efficient use of systems. The impediments, as ranked by survey respondents, are privacy concerns, lack of hardware and software, poor data quality, internal reluctance to share, lack of staff support, lack of policy, and inconsistent work rules.

The two examples of integration that currently occur within the County are for parcel data and financial (Account/Budget) data. Parcel data are shared internally and with the City of Seattle. Of the several ways to share data, the County typically uses the most basic format available, which involves point-to-point batch file transfers.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ There is recognition among agencies that data integration and sharing would be beneficial. ✓ The County currently uses some tools that allow disparate applications to communicate with each other. ✓ Current integration efforts include use of middleware and data warehousing.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ The current tendency to create point-to-point integration between systems creates a complex web of interfaces that are difficult to maintain. ✓ Integration is significantly lacking around the County. ✓ There is no County policy regarding how systems should be integrated. ✓ No organization is assigned the responsibility over data management. ✓ TMB members identified lack of hardware and software technology as a major impediment to achieving integration.



C6. Operating Systems

Operating systems provide an important software component supporting County databases and applications. Historically, operating systems have been managed both centrally and decentrally by those responsible for applications and hardware.

In this sense, acquired operating systems have had little impact on technology advancement and have been implemented mainly as a result of application software requirements. The County operates mostly mainstream operating systems including Unix, Linux, and multiple versions of Windows. Other proprietary systems are used on older types of hardware. LAN operating systems used are a mixture of NT and Novell Netware. Because of the interoperability of today's operating systems, the County has not been overly hampered by the multitude of systems in place. However, should the County move to further standardization, fewer operating systems will be required in the future. There is an opportunity to limit the number of these systems, thus providing a more manageable environment over the long term.

Findings:
– Numerous types are in place, including Unix, Linux, Windows, and other proprietary systems
– Mainly mainstream systems are in use.
– Further opportunities exist to standardize.

There is some momentum to operate on one platform for each of the major technology components in operation, including network, Web, servers, etc. For example, the County is currently in the preliminary stages of upgrading the Windows NT domains to the Windows 2000 platform. This is a prudent decision. However, this project is large and one that must be carefully planned and managed. The County's extensive server farm and the current number of Windows NT domains increase the level of risk faced by the County during this standardization process. Particular risks requiring attention include the current distributed network over a WAN (which represents potential synchronization issues), the distributed nature of staffing and technology management (with large projects being more difficult to manage in noncentralized environments), the large number of "trusted domains" that will need to be eliminated or connected to the Active directory, and the considerable degree of variance in the maintenance of the current windows NT domains. Wisely, the County has been working directly with Microsoft consultants in the early stages of the project and has received valuable support in this area.

It will be critical for the County to establish a well-defined testing system for this project and a plan that provides large blocks of time for assessment and deployment. Microsoft has published extensive documentation to guide upgrades of this type. Continuing to partner with Microsoft or another MS-certified vendor will significantly reduce the risks associated with implementation. Additionally, the County should aggressively project manage all phases of the implementation.

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| <i>Strengths:</i> | ✓ Operating systems are adequately supporting the many systems in operation around the County. |
| | ✓ Many powerful systems are being utilized including Unix, Linux, NT, etc. |
| <i>Weaknesses:</i> | ✓ Many different systems are in use, requiring extra work to maintain. |



C7. User Interface/Office Automation

There is an assortment of desktop operating systems running on the County's network, ranging from Windows 3.1 to Windows XP. The hardware on which these systems reside varies considerably. Despite this variability, the user environment appears to be operating adequately. The desktop tool set in use is

Microsoft Office, although versions differ. The most heavily used suite of applications includes Microsoft Word, Excel, and calendaring functions. To promote compatibility, many County installations of the productivity suite will automatically "save down" to an early version of MS Office, thereby allowing users with old systems to be able to adequately read files. Operating a consistent office suite will significantly reduce maintenance costs in the future.

Findings:

- Office automation tools are functioning adequately.
- Standardized on MS Office Suite (although versions vary).
- Increased management will be required to streamline maintenance.

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| <i>Strengths:</i> | <ul style="list-style-type: none"> ✓ County is using industry standard Microsoft software. ✓ Many end-users appear to have strong skills in use of such applications. ✓ The tool sets have increased end-user productivity. |
| <i>Weaknesses:</i> | <ul style="list-style-type: none"> ✓ Different versions are in use around the County. |

C8. Servers

County servers vary considerably with regard to performance, maintenance, hardware specifications, configurations, and suitability for required tasks. The majority of the servers maintained run Novell and Microsoft operating systems.

Findings:

- A wide variety of servers are in use (both brands and types).
- Some servers are performing reasonably, while a limited number should be replaced.
- Servers are not treated as an enterprise asset.

The variety of existing servers reflects the decentralized technology environment that has developed over the years. Server operations are distributed to the degree that a number of like servers with similar uses are underutilized, thereby increasing the cost of maintenance. This is particularly evident when examining Web and file storage servers. Because servers are managed decentrally, the equipment is not treated as an enterprise asset. As a result, the County is missing an opportunity to share capacity and storage, thus being more efficient.

As with workstations, there are a number of servers that are high performing, low maintenance, and meeting service expectations with little administrator intervention. However, a number of older servers also exist that are problematic and unreliable. The variation of network operating systems running on the servers is also an issue that leads to further inefficiencies. NetWare 4.11, 5.1, Windows NT and 2000 are all found operating on the County WAN. No standards are in place to regulate server computing and manage server support.



The number of servers operating with local backup devices and software is not cost-effective. A more centralized backup capability would allow for greater control over capacity. Reduction of the number of local backup drives would also decrease the amount of backup media needed to protect agency data.

<i>Strengths:</i>	✓ Many servers are high performing. ✓ Many servers are meeting the needs of the user base.
<i>Weaknesses:</i>	✓ There is no standardization of hardware and corresponding operating systems. ✓ Decentralized technology environment is not making best use of assets.

C9. Databases

As with operating systems, multiple types of databases are utilized within the agencies, supporting multiple types of applications. These databases range from high-end systems such as Oracle, to small PC-based platforms such as FoxPro and Paradox. The mainframe uses Adabas and VSAM database file structures. But unlike operating systems, database selection and consistency is more critical to the County, primarily because of

the need to support improved data integration and sharing. In the past, many database decisions have been made by technicians at the agency level without thorough insight and understanding of Countywide needs. Database selection to date has been largely driven by those selecting or building systems for a specific use. Recent grassroots momentum has been building to use Oracle on the high end for larger enterprise systems, and SQL Server for departmental systems. These efforts have not been formally endorsed by County management. Many smaller multiuser systems have also been built in Access. Because there is a lot of history with some other lesser-known systems, these persist, are needed, and are scattered throughout the County. For this study, the County's databases are categorized as mainframe, relational, and nonrelational tools. Each category is discussed further below.

Findings:

- The existing mainframe data management products reliably meet the County's near-term needs for existing applications.
- The County is moving toward standardizing on the two leading technologies, Oracle and SQL Server.
- Many types of databases are in use, ranging from high-end systems to small PC-based platforms.

a) Mainframe

The County runs two mainframe data management products, Adabas, a hierarchal database from Germany's Software AG; and VSAM, which is the native file system that runs on the mainframe. Systems that use VSAM have their data definitions embedded within the program code, making them difficult to modify. In contrast, Adabas data is defined and modified by database utilities external to the program code, so systems using Adabas tend to be more flexible and easier to maintain. Although reliable, mainframe tools are not as flexible or as functional as the modern relational products in use. For illustrative purposes Table 10 identifies several of the systems running on each of the mainframe products.



Table 10: Mainframe Database Applications

Adabas	VSAM
<ul style="list-style-type: none"> Accounts Receivable Accounts Payable Real Property Tax Roll Personal Property Tax Roll Pet Licensing Voter Registration and Elections 	<ul style="list-style-type: none"> Fixed Assets ARMS Financial Management MSA Payroll package Purchasing package PROMIS (Prosecuting Attorney's Office) SEA-KING SIP Subject in Process — Adult Detention Roads — Traffic Engineering

All mainframe applications are maintained by County staff. Because of the age of the technology, support staff possess skills that are becoming increasingly difficult to find in the marketplace. However, as necessary, staff may still be trained to support the applications.

b) *Relational*

Besides mainframe data management products, the County also runs the two leading relational databases, Oracle and Microsoft SQL Server. Oracle is used for a variety of systems, including both enterprisewide and departmental applications. SQL Server is mostly used for departmental systems. Both of these products enjoy a solid market share and may be relied on with little risk. Although the County would likely achieve some increased efficiency if only one of these products were in use, the size of the County and the differing requirements for its applications support use of both systems tailored to the requirements of the specific situation. Presently, Oracle is used as the data store for the large-scale ARC-Info GIS system, and for PeopleSoft and Oracle financial applications. Oracle is available to run on almost all operating systems (including the mainframe) and is known to be superior in capacity and performance. The product also runs on UNIX, which is used as a primary client server platform at the County. SQL Server does not have a reputation for being as robust as Oracle, but the latest releases have improved sufficiently to be suitable for many enterprise applications.

Additional database technologies are used in specific situations. For example, Ingress (a RDBMS from Computer Associates) is currently used for a few departmental applications. Another relational product, Informix, is used at the Department of Development and Environmental Services (DDES) for the Accela integrated suite of permitting applications. A number of agencies use other LAN-based tools for some work group systems, including MS Access, Clipper, and FoxPro. There is also widespread and increasing use of Microsoft Access for work group systems.

Each DBMS tool has its advantages and disadvantages. The differences make the tools suitable under different circumstances. Table 11 illustrates the main differences between the leading relational DBMS products. DB2 is the only one not in use at the County. It is included to provide a comparison for mainframe-based technology.



Table 11: Comparison of Relational Database Tools

Feature	Oracle	SQL Server	DB2	MS Access
Enterprise scale	Yes	Yes	Yes	No
Relational standards	Good	Good	Good	Moderate
Competitive cost	High	Moderate	High	Very low
Ease of use	Advanced	Moderate	Advanced	Easy
Market share	Strong	Strong	Adequate	Strong
Runs on mainframe	Marginally	No	Yes	No
Runs on Microsoft NT	Yes	Yes	Yes	Yes
Runs on UNIX	Yes	No	Yes	No
Ongoing maintenance costs	High	Moderate	Moderate/High	Low

c) *Nonrelational*

Nonrelational databases play a key role in the County's infrastructure. While it is considered best practice to standardize on relational architectures, there are situations in which more specialized processing is needed and the cost of using a relational tool may be prohibitive in terms of redevelopment. One example of a nonrelational database involves spatial databases, which are designed specifically for maintaining and rapidly processing geographic data. A second example involves HTML (documents), which is used in Web pages and Web-based business transactions. In some cases the relational vendors provide extensions to their products for these needs (such as Oracle's and DB2's Spatial Database features), and in others the database is designed in a nonrelational format. Use of nonrelational databases has a long history at the County, especially considering that older legacy systems were developed prior to relational technology's becoming mainstream.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ Mainframe database products are reliable and provide excellent performance.✓ There is little business risk associated with using VSAM or Adabas.✓ The relational databases in use have become de facto standards supporting business applications.✓ The two enterprise products in use at King County are the market leaders and can be relied upon for future use with little risk.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ VSAM does not have the advanced features of a database management system.✓ Neither VSAM or Adabas are relational model products.✓ Oracle is a more complex environment in contrast to SQL Server, and requires more support from highly trained technicians.



C10. Data Warehousing

Data warehousing is one of several data integration mechanisms in use at the County. Warehouses are specialized databases that use data extracted from other operational systems for reporting purposes. Data warehouses are different from operational databases in several different ways, as identified in Table 12 below.

Findings:
<ul style="list-style-type: none"> – Widespread use of warehouses has not yet occurred; however, agencies are looking to warehousing increasingly for solutions to their data management needs. – Data warehouses provide the potential to combine data from disparate sources together into a single reporting capability. – Data warehousing is one of several data integration mechanisms in use.

Table 12: Data Warehouses versus Operational Data Stores

Characteristic	Data Warehouse	Operational Data Store
Scope	Wide — allowing reporting on many related topics	Narrow — efficiently support specific processes
Retrieval	Masses of data provided for comparisons and analysis	Transactions-based using consistent repeating patterns
Timing	Point-in-time “snapshot” needed for a consistent view	Continuous state of change linked to daily workflows

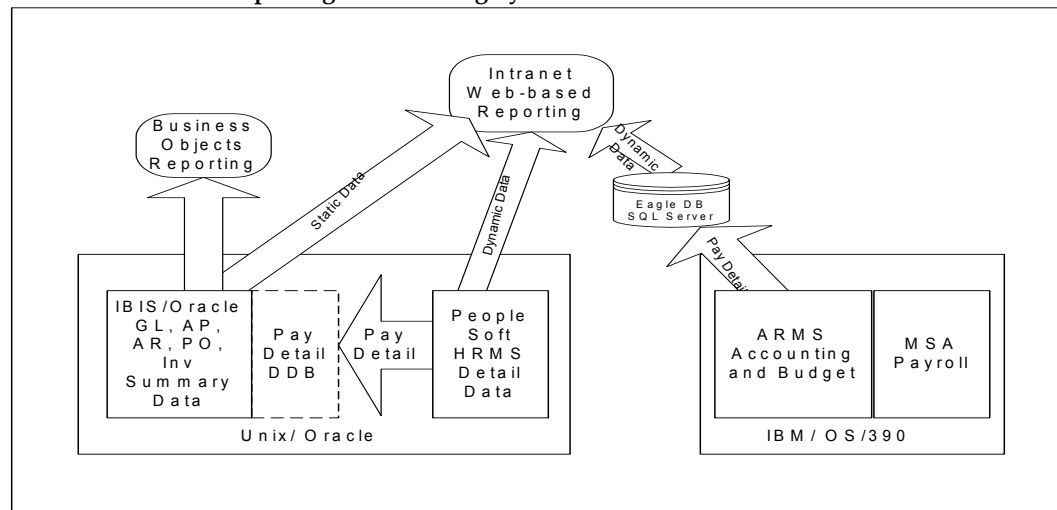
Technically, data warehouses exist because designers have found that it is not always practical to have a single database design that serves both operating and reporting purposes. Data warehouses are designed specifically for indexing, redundancy, and design patterns that allow for easy and efficient reporting.¹ Although the County’s current relational servers (Oracle and SQL server) are well able to support data warehouse processing, in some cases some specialized data warehouse products are also being used. Reporting from data warehouses normally requires specialized On-Line Analytical Processing (OLAP) software that can efficiently provide needed data aggregation and manipulation functions. The County currently operates two such products, including Crystal Reports and Business Objects.

Several County agencies have developed data warehouses for their own use. For example, the Finance Department has developed a Web-reporting database, depicted in Exhibit 2 below, that is available to users who are connected to the County’s intranet. The reporting environment submits queries to the Oracle system and to the SQL server extract from the ARMS system. Information is extracted from each of the source systems. Similarly, the GIS group has developed a warehouse that combines data from several systems into a location-keyed Oracle tabular database. Additionally, several other agencies have created data warehouses to support their reporting needs.

¹ The term “data warehouse” has come to be associated with large enterprisewide reporting initiatives. Smaller, department-specific reporting databases are known as “data marts.” In this report, the term “data warehouse” is used to refer to any database designed specifically for reporting and/or data exchange.



Exhibit 2: Financial Reporting Warehousing System



- Strengths:**
- ✓ Current relational databases, including Oracle and SQL server, can be used for data warehousing purposes.
 - ✓ Financial reporting is being enhanced through warehouses already in place.
 - ✓ Agencies are beginning to make active use of data warehousing as an integration tool.
- Weaknesses:**
- ✓ No comprehensive approach exists at the County related to data warehousing.
 - ✓ Some important data is not yet available through data warehouses.
 - ✓ The County does not own the needed extract-transform-and-load (ETL) software needed to efficiently maintain data warehouses.
 - ✓ There is a lack of data-modeling skills in the County that are needed to design warehouses.
 - ✓ No operational model in place.

C11. Telephone and Voice Mail

The County's network of NEC, Fujitsu, Nortel PBXs, and key systems are connected to the Public Switched Telephone Network (PSTN) via leased services from local exchange carriers (Qwest and Verizon). All County-owned equipment runs on County owned/leased property with the exception of colocated I-NET nodes. As stated earlier in the

assessment, with few exceptions, the voice-switching systems are disaggregated end points that allow inter-County office communications via the local exchange carrier switch only. The voice switches are not privately networked and are based upon three proprietary types of PBXs and multiple, limited function key systems with autonomous interconnected voice mail systems. Several of the PBXs appear to be approaching the end of the equipment lifespan. Further, none of PBXs have multiplexed streaming data request software or call detail recording enabled for enhanced functionality.

Findings:

- The telephony network at King County is fragmented and served by different providers.
- Voice-switching systems are disaggregated, and various systems are in use to support voice mail.
- The County requires additional assessment, analysis, design tasks, and cost/benefit studies before a plan may be implemented to deploy VoIP.

Exhibit 3 depicts the existing switching system environment. The existing system prohibits deployment of practical call detail recording, standardization of unified messaging, voice over IP (VoIP), or implementation of other advanced applications. It should be noted that ITS has initiated a procurement process to obtain external assistance in initiating a Telephony Stabilization Project to help identify ways to improve current operations.

Moss Adams Advisory Services



2004. Other County voice mail users are served by various stand-alone voice mail systems installed on Meridian PBXs and NorStar key systems.

The County has conducted one brief trial related to implementation of VoIP. The trial resulted in a determination that the County is not yet ready to deploy the technology. During this study no specific trial data were available to validate the cost/performance advantages of the technology. The technology delivering VoIP must involve strict criteria for the many required network elements. For the future, the bandwidth provided by I-NET will enable a pure IP transport with carrier-grade quality. The active electronics between the desktop telephone set and the serving voice switch, or PSTN, will ultimately determine the quality of the service. Many of the County's voice-switching systems support upgrades to enable VoIP connectivity between switches, and between switches and IP telephone sets. Many providers of soft switches and IP telephone-switching systems also offer autonomous systems that can deliver voice over the County's WAN. In those areas where central office services (Centrex) are used for voice and leased lines for data, a consolidated VoIP solution could yield substantial savings in the future. Future testing of the technology will allow the County a means to determine the size of the opportunity.

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| <i>Strengths:</i> | <ul style="list-style-type: none">✓ The majority of County-owned PBX voice-switching systems, though proprietary, are manufactured by tier-one manufacturers, and many are potentially upgradeable.✓ Voice services provided via VoIP technology can be implemented on a small scale almost immediately.✓ Technologies implemented as part of the I-NET project have the potential to provide a suitable transport mechanism for VoIP between Ethernet switches.✓ The single-mode fiber and assumed-loss budgets in AT&T's construction of the I-NET guarantee quality of service equal or extremely close to toll quality.✓ In those areas where central office services (Centrex) supports staff for voice and leased lines for data, a consolidated VoIP solution could yield substantial savings to the County.✓ Many of the County's voice-switching systems support upgrades to enable VoIP connectivity between switches, and between switches and IP telephone sets.✓ Many providers of soft switches and IP telephone-switching systems offer autonomous systems that can deliver voice over the County's WAN. |
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- Weaknesses:*
- ✓ King County's voice-switching systems have evolved into a disaggregated collection of disparate and distributed systems.
 - ✓ The distributed telephony network consists of three proprietary PBXs and multiple limited-function key systems with autonomous interconnected voice mail systems.
 - ✓ Several of the PBXs are at the end of their life cycle.
 - ✓ None of the PBXs have SMDR software or call detail recording functionality enabled.
 - ✓ The centralized voice mail system appears at capacity without an option for hardware expansion or software upgrade. The current voice mail system is 14 years old and has been determined to be "non-serviceable" by its vendor. It is tentatively scheduled for replacement.
 - ✓ If VoIP is used to replace existing, first-generation PBX equipment, financial benefits may not be available in the short term.
 - ✓ ATM is a solid transport vehicle for voice when such transport is at a DSx basis (i.e., T1 or DS3); however, it is not the correct vehicle for VoIP and not the preferred transport for IP.

C12. Wireless

Wireless is a transport mechanism that literally "replaces" the physical connection to the network. Wireless conceptually could be employed in many agencies. However, agencies are mostly unaware of the current limitations in speed, bandwidth, and coverage that will dramatically affect overall transport performance. Wireless local area network connectivity ideally supports mobile operation of intelligent devices. A potential use at the County is in the Sheriff's Office, where officers could connect their laptops into the network. Potential connectivity would provide seamless access across the enterprise for computers equipped with wireless network interface cards.

Findings:

- Wireless use is in its infancy within the County.
- May provide cost-effective solutions in particular circumstances, but little analysis has been conducted to date.

The County currently has very limited wireless technology in place. Efforts to date have included utilizing Cellular Data Packet Data (CDPD) and Ricochet modems. Ricochet modems were used prior to the company's demise. The roughly 210 units that were in use have not been replaced. CDPD application has not moved beyond the discussion stage because overall standards for use of wireless are not well defined. Overall, wireless applications have been recognized as potential opportunities at the County for cases in which one of the following situations or requirements is present:

- Need for rapid deployment of a "temporary" LAN (e.g., a LAN set up at a public facility for online voter registration)
- Historic buildings that cannot be modified
- Open office or work environment(s) with low-density work force
- Application-specific requirements with "mobile" staff using laptops and/or PDA devices



Very little planning has occurred regarding wireless technologies. It is apparent that further cost/benefit analysis would be useful to the County, particularly directed at those personnel who work in the field.

<i>Strengths:</i>	✓ Limited investment of time/resources has occurred to date.
	✓ Technology offers potential cost-effective solutions, particularly for staff out in the field.
<i>Weaknesses:</i>	✓ There is no defined plan for deployment of wireless, and no recognition of Cellular Data Packet Data (CDPD) as a viable network transport medium.
	✓ There is no standard for mobile devices, including personal digital assistants (PDAs).

C13. Applications

Applications are the software systems being utilized by end-users throughout the County. Some applications cross agency boundaries and can be categorized as enterprisewide, while others are utilized only within agency boundaries. Enterprisewide systems addressed in this assessment include Financial systems (ARMS, IBIS), and Human Resources/Payroll systems (PeopleSoft, MSA). GIS and Document Management systems are also in use and discussed. Agency-specific applications include the numerous client/server and mainframe functions utilized by LS&J agencies, Public Health, Transportation, Natural Resources, and the Department of Assessments.

a) *Enterprisewide*

Enterprise applications are those that are utilized across the County. Two primary business systems are recognized as providing enterprise functionality: Human Resources/Payroll and Financial. Currently, two separate computing platforms are being utilized for Human Resources/Payroll, and two others support the Financial function. These four systems are listed in Table 13 and are further discussed below.

Findings:
– Using multiple separate enterprise systems reduces efficiency and significantly increases support requirements.
– Current systems require reconciliation to produce Countywide reports.
– Moving to one of the two current systems is not possible without significant effort and workflow reconfiguration.

Table 13: Finance and HR/Payroll Systems

System	Function	Database Environment	Development Language	Source
MSA	HR/Payroll	VSAM/Adabas	COBOL	Third-party package, custom developed
PeopleSoft	HR/Payroll	Oracle	Proprietary programming language	Third-party package
ARMS	Finance	VSAM	COBOL	Third-party package, custom developed
IBIS	Finance	Oracle	Oracle tools	Third-party package



(i) *Finance*

The County is operating two separate financial systems: the Oracle “IBIS” system and a modified packaged mainframe system called “ARMS.” Both systems serve a number of agencies. The Oracle system originated through the Metro Transit merger. This system uses recent technology employing Oracle Corporation’s public-sector applications running over the Oracle database. The functionality available within this system is robust and is generally current with state-of-the-art governmental applications available in the marketplace. The specific version, however, is several years old. The ARMS system is the older of the two, is customized, and has been modified within the County over the past 20 years. ARMS runs over the mainframe on VSAM files. The software is not meeting all of the County’s current end-user needs, is cumbersome, and lacks a user-friendly interface.

(ii) *Human Resources/Payroll*

The County also operates two separate Human Resources/Payroll systems: PeopleSoft and MSA. Like the Financial systems, one uses current technology (PeopleSoft), and the other is an older mainframe-based system. This dual-system configuration is similar, in terms of business issues, to that of the Financial systems situation. PeopleSoft was installed in 1999. The mainframe-based MSA system is dated and has a narrow set of HR/Payroll functionality.

PeopleSoft was originally installed for those employees who were tracked in the ISI system. The County now operates version 7.01, which is not the most current release. Modules being utilized include human resources (including applicant tracking), payroll, benefits administration, and time and labor. The modules support roughly one-third of the County’s employees and interface with the IBIS system. System expansion cannot occur to the remaining agencies’ employees without significant reconfiguration of the software. This limitation is due to the particular functionality needed to process information for the many remaining bargaining units not currently running on the system. The one PeopleSoft application utilized across the County is the applicant-tracking module.

In contrast, MSA is a mainframe application that has been in operation since 1976. The software was originally developed by Management Science America; it has since changed hands several times and is now supported by GEAC. The County is not operating the latest version of the software, but the current system is reported to be stable. The system was last upgraded in 1999, and another upgrade is planned for spring 2002. The system is configured to support approximately two-thirds of the County’s employees, and interfaces with the ARMS system.



County personnel fully recognize the potential benefits of migrating to one integrated system. Key problems repeatedly noted with the running of dual systems include the following:

- The difficulty involved moving employees from one system to another when personnel transfer departments. This limitation has resulted in employees being processed on two different systems even though they may work for the same department.
- The requirement for operating two systems at the same time (because PeopleSoft is required for applicant tracking across the County).

The primary barrier to using only one of the two systems is the tie to different payroll cycles in use at the County. The MSA system is configured to pay on the semimonthly cycle, while PeopleSoft is configured to pay on a biweekly cycle. Neither package may be reconfigured easily to support the whole County.

As a result of the dual-system environment, other subsidiary systems have also been developed to supplement Human Resources/Payroll functionality. These systems include established databases for tracking temporary employees, applicant claims processing, and diversity reporting. Use of these stand-alone systems has resulted in the introduction of errors and required reconciliations with the relevant primary human resource and applicant tracking systems. Further, human resource functions conducted outside of the automated systems (such as position control) are not integrated with either primary system and require extra synchronization.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ Each system allows user agencies to maintain unique characteristics (i.e., number of hours in a standard work week).✓ Systems have been running reliably — PeopleSoft for 2.5 years, MSA for 26 years.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Significant time is spent reconciling data between HR/Payroll and Financial systems.✓ Numerous additional stand-alone databases have been developed for tracking data that are not maintained in the separate systems.✓ Departments report information differently depending on what systems are used.✓ OHRM lacks ownership of the human resource data and has limited confidence in its ability to produce accurate reports.✓ Neither HR/Payroll system supports the desired payment cycle without significant reconfiguration.✓ The MSA organizational structure is not in synch with the ARMS numbering scheme, and reports can only be generated following an offline analysis of the information.✓ Workarounds to overcome shortcomings in MSA have created inconsistent and inaccurate data.✓ Documentation for modifications to the systems is lacking.✓ Only a limited number of people have access to the MSA system, and very few of those have the authority to operate the system.



b) *GIS*

GIS is a key technology supporting many core business functions at the County, including Public Health, Elections, Permitting, Transportation, Utilities, Assessment, and Taxation. The current level of integration between GIS and non-GIS legacy systems is weak. In support of these functions, the County runs Environmental Systems Research Institute (ESRI) software. ArcINFO software is used to maintain GIS data and also for advanced analyses. The desktop software package, ArcView, is also used at numerous locations for data display and analysis. GIS data is routinely linked with tabular databases such as Oracle and Microsoft Access.

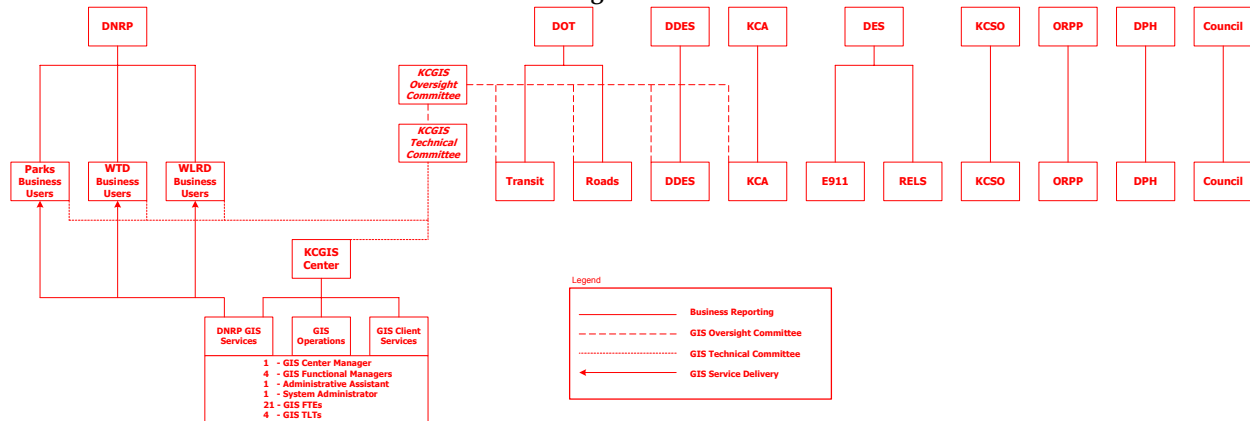
Findings:
<ul style="list-style-type: none"> – GIS is an important application supporting numerous agencies' business functions. – Integration of past legacy GIS databases is poor and has led to many inefficiencies. – The County has significant personnel resources available supporting GIS. – GIS standards will be critical for the County to realize its goal of becoming a regional GIS provider. – A well-designed GIS data warehouse is central to providing a multi-agency system.

Full utilization of GIS architecture depends heavily on the various agencies' efforts to work together. The GIS organization is distributed between different departments within the County. In the past this created problems in achieving effective coordination and cross-department collaboration. Recently, however, steps have been taken by the County Executive to clarify overall responsibility for all County activity by moving the GIS Center from ITS to DNRP, and giving the DNRP Director overall responsibility for all aspects of enterprise GIS. In this process it was also decided to combine the 11 GIS staff working in Wastewater Treatment, Water & Land Resources, and Parks divisions into a single DNRP GIS Unit, colocated and managed at one site.

To ensure improved technical collaboration and strengthened management oversight of GIS activity, two new committees have been established. The relationships of DNRP, the GIS Center in DNRP, and GIS Units located in other County agencies are illustrated in Exhibit 4, which provides an extract from the County's existing, comprehensive diagram depicting the consolidated GIS organization:



Exhibit 4: GIS Consolidated Organization Overview



The organizational changes described above were prompted to address a number of inherent inefficiencies in the previous organization and to position the County as a GIS service provider to member cities and districts. The vision involves the delivery of this service via Web-based systems on the Internet or via I-NET.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ Technology systems utilize advanced industry standard software (ESRI).✓ The reorganization of the GIS entities promises to support increased system use.✓ The relocation of the function to DNRP will provide a more reliable funding mechanism for GIS. The primary focus will be to maintain the GIS Spatial Data Warehouse, and provide access to the rest of the County.✓ Key GIS leaders in each of the linked departments are seasoned experts with in-depth knowledge to support practical utilization of systems.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ There is no strategic framework in place for directing and unifying GIS efforts.✓ Data standards are agency specific and used inconsistently.✓ Data ownership concerns associated with varying agencies' utilization have not been fully addressed.✓ The core data set for the County is "Parcels Coverage," which is a key data set designed around a cumbersome data structure; it has become outdated and caused synchronization problems.✓ Many key GIS datasets are not integrated.✓ Some GIS groups have resisted centralization efforts.



c) *Document Management*

Document management involves the processes and systems in place to store, track, and retrieve records-based information. Many agencies manage documents through the use of the network and word processing. No enterprisewide capabilities have been

implemented, nor is there a plan to do so. Some document management systems are set up decentrally within the agencies. For example, the Department of Judicial Administration utilizes two applications including Electronic Court Records and CRIMS. Both of these applications have been developed by external vendors. The Electronic Court records system has been in place since 1999, while CRIMS was installed in 1997. Additionally, the County Records Department operates a record center that stores over 100,000 cubic feet of inactive records disbursed in four separate locations. Records are tracked via an Access database. The Records Department system was designed by an external vendor.

Findings:
<ul style="list-style-type: none"> – No enterprise standard systems are in use. – Most agencies use word-processing applications to store and retrieve documents. – Department of Judicial Administration uses a specialized form of document management.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Some document management is available to track document storage and retrieval functions. ✓ The systems in place have been tailored to meet the unique needs of the County, as in the case of Judicial Administration.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ There is no enterprise document management system available for agencies to use. ✓ Most document management processes are time-consuming and inefficient except in the instances in which document management tools are used. ✓ Document management systems are not well understood by the personnel responsible for the functions.

d) *Agency/Specialized*

There are many legacy software systems operating within agency environments including LS&J, Public Health, DOT, DNRP, and the Department of Assessments. Legacy systems represent investments in technology that are aging and sometimes difficult to maintain because of lack of vendor support, diminishing expertise, inflexibility, and a lack of compatibility with state-of-the-art architecture. Generally, existing systems are operating viably. In some cases these systems operate at high performance levels (e.g., as in the case of Public Health). Other systems are operating in more fragile states, such as in the case of Roads' systems. The County's major specialized systems are described below.

Findings:
<ul style="list-style-type: none"> – For the most part operating viably, however, some systems require a fair amount of maintenance. – Unique set of applications that are heavily customized. – Disparate set(s) of modules. – Mainframe technology can continue to sustain LS&J systems for the near term. – Much of the current software has exceeded its original design life.



(i) *Law, Safety, and Justice*

Law, Safety, and Justice (LS&J) agencies are supported by a number of disparate systems that have evolved to address different, but related, business needs for the Sheriff, Prosecutor, Courts, and the Jail. Current systems are operating viably but are inefficient and a challenge to maintain. The systems use mostly customized software, run over the mainframe, and are not integrated. This situation has resulted in two primary issues. First, storage, tracking, and retrieval are accomplished inefficiently. Second, data flows through the various business units redundantly, requiring the handling of the same data repeatedly, often with manual reentry required. The most pressing need within LS&J is to share records-based information about people, which is needed by all business units and passed on from agency to agency in daily workflows. Overall, LS&J agencies report that their own business rules have been defined as substantially unique, and consequently, past system efforts have focused on developing custom systems instead of installing packaged software and linking systems.

To foster improvements in this area, the State of Washington has become involved by developing standard data definitions. Use of standard definitions is intended to help unify the design and management of new LS&J systems. As it is now, fragmented systems design has diverted attention from standardizing workflow. State data definitions will help establish standards for data interchange and reduce the risk of building disintegrated systems. Ultimately, standardization is needed to promote compatibility among LS&J systems in the criminal justice arena, both within the County and with external business partners.

The core components of LS&J's systems revolve around numerous primary software applications and several special-purpose applications required in support of case management. It is worth noting that several of these key systems are developed and maintained at state and federal levels, and are integral to the County's overall architecture. Core LS&J software applications and the information available about them are listed in Table 14.



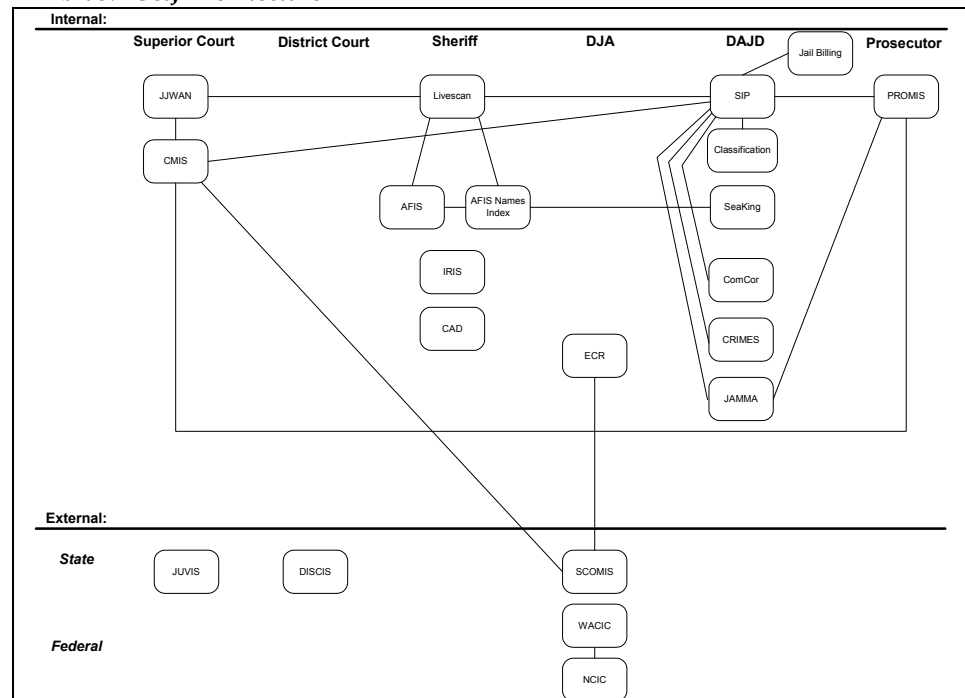
Table 14: Primary LS&J Applications

Application Name	Acronym	Platform	Function
Incident Report and Investigation System	IRIS	NT Server	Core case investigation and management system for Sheriff
Computer-Aided Dispatch System	CAD	DEC VAX	Sheriff dispatch within 911 call center
Automated Fingerprint Identification System	AFIS	NEC	Fingerprint system
AFIS Index	ANI	MF IBM 2003	Indexing system for AFIS
Livescan		Unix Server	Electronic entry into AFIS
Prosecutor Management Information System	PROMIS	MF IBM 2003	Core case-management system for Prosecutor
Subject in Process	SIP	MF IBM 2003	Core jail system
Sea-King		MF IBM 2003	Indexing and locator system for DADJ
Classification	CLS	MF IBM 2003	Inmate classification
Jail Billing	CKS	MF IBM 2003	Billing of jail costs to municipalities
Crimes Capture System	CRIMES	NT Server	Electronic mugshot system
Jail Master Movement	JAMMA	NT Server	Single-source scheduling for inmates for various activities
ComCor	ComCor	NT Server	Work-release management system
Court Management Information System	CMIS	Unix Server	Core case-management system for Superior Court criminal cases
Juvenile Justice Wide Area Network	JJWAN	NT Server	Core case-management system for Superior Court juvenile cases
Electronic Court Records	ECR	FileNet Server	Document imaging and management system
Superior Court Management Information System	SCOMIS	External System	Official system of record for all Superior Court cases in State
Juvenile Court Information System	JUVIS	External System	Official system of record for all Juvenile Court cases in State
District Court Info System & Judicial Acct Sub-System	DISCIS	External System	Official system of record for all District Court cases in State
Washington Statistical Information System	WASIS	External System	Information not available during study process
Washington Crime Information Center	WACIC	External System	Information not available during study process
National Crime Information Center	NCIC	External System	Information not available during study process
National Crime Information Center III	NCICIII	External System	Information not available during study process

These applications interface in a number of ways, as depicted in Exhibit 5 below. The schematic was developed as part of a Law, Safety, and Justice integration study that was conducted during fall 2001.



Exhibit 5: LS&J Architecture



Every LS&J system currently has established initiatives to replace existing applications. The bases for moving forward with such initiatives are inflexibility, aging technology, high maintenance, and a lack of functionality.

(ii) *Public Health*

The operations for Public Health are widely disbursed to over 40 service delivery units. Systems support over 1,800 users and are serviced by 26 IT staff. The only system used centrally is a grants management application. The Department's operational systems are unique to the health care services delivery function, and many of these systems are required by external regulatory bodies.

Public Health systems have been designed around several key databases. Unique applications have been developed to run over SQL server, Access, Clipper, and Delphi databases. Web and client-server applications are also operated for data-tracking purposes. Despite being well designed and operating adequately, many of these systems are continuing to age in terms of functionality.

The Department relies on internal technology staff who have the specialized expertise to support the unique systems. Health Department staff support the applications with both primary and secondary support for each of the various systems in place. Key systems within Public Health are noted in Table 15.

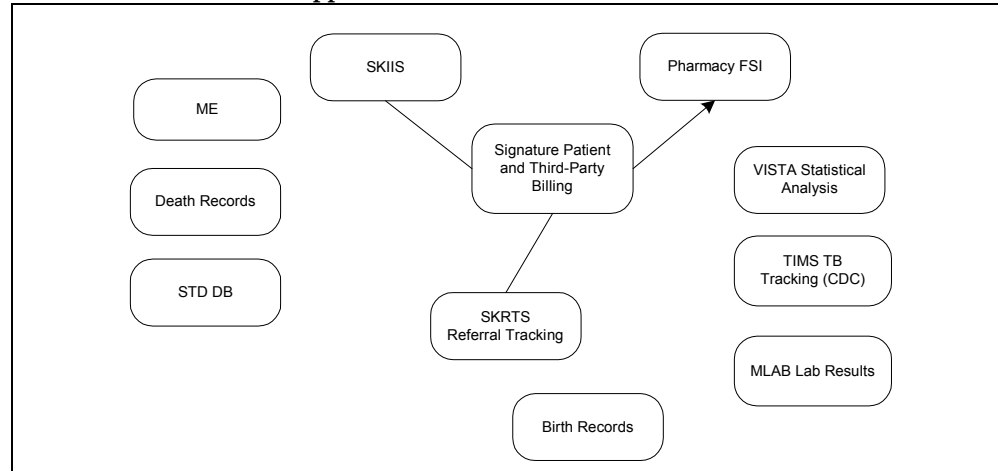


Table 15: Public Health Systems

Application	Function	Technology
Signature	Medical billing	Mainframe (ASP), SQL Server, and Access
SKRTS	Patient encounter tracking and billing	Clipper and Delphi
SKIIS	Supports statewide immunization tracking	Web application
Envision	Environmental permit tracking	Client-server, Sybase
TIMS	TB tracking	Client-server, Sybase
MLAB	Lab results system	Client-server, Cache/e-based
VISTA	Statistical data store	
Pharmacy FS1	Prescriptions and tracking of pharmaceutical inventories	Client-server
Medical Examiner	Tracks records for the Medical Examiner	MS Access
Birth Records	Tracks birth records	State provided
STD Tracking	STD database	MS Access
Death Records	Database of death certificates	MS Access

These core applications are depicted in Exhibit 6.

Exhibit 6: Public Health Applications Architecture





(iii) *Department of Transportation (DOT)*

The DOT includes transit, roads services, and fleet administration functions. Applications reported by Transit and Roads are discussed below. Information from Fleet Management was not provided as part of the study process.

- *Transit*

Existing legacy systems operating in Transit are unique to the public transportation business. Most applications are operations based and rely on databases to support the tracking of business information, as in the case of the bus stop inventory. A number of these systems are aging and do not meet all requirements needed by the agency.

A plan is in place to replace many of the systems with currently available vendor products. The centerpiece of the plan is to conduct a three-phase program over three to five years for life cycle replacement of obsolete vehicle-information systems. Systems being replaced on vehicles include the driver display, the on-board computer, and the radio/AVL system. The Transit plan includes integrating the automatic passenger-counting system, providing automated stop announcements and destination signs, automated vehicle monitoring, and improved transit-signal priority information. A regional smart card fare-payment system is currently under construction.

Projects will replace customer assistance, bus operator, dispatch, work assignment, timekeeping, and bus stop functions. In addition, significant upgrades and enhancements are planned for the “distribution database” (DDB), which collects and manages information in a central format. This DDB is central to transit reporting and is connected to many of the operational applications. A divisionwide data model was created as the basis for the original DDB and is being updated as other systems are updated and replaced. Transit maintains Oracle expertise in-house to support DDB. The primary applications in use are listed in Table 16.

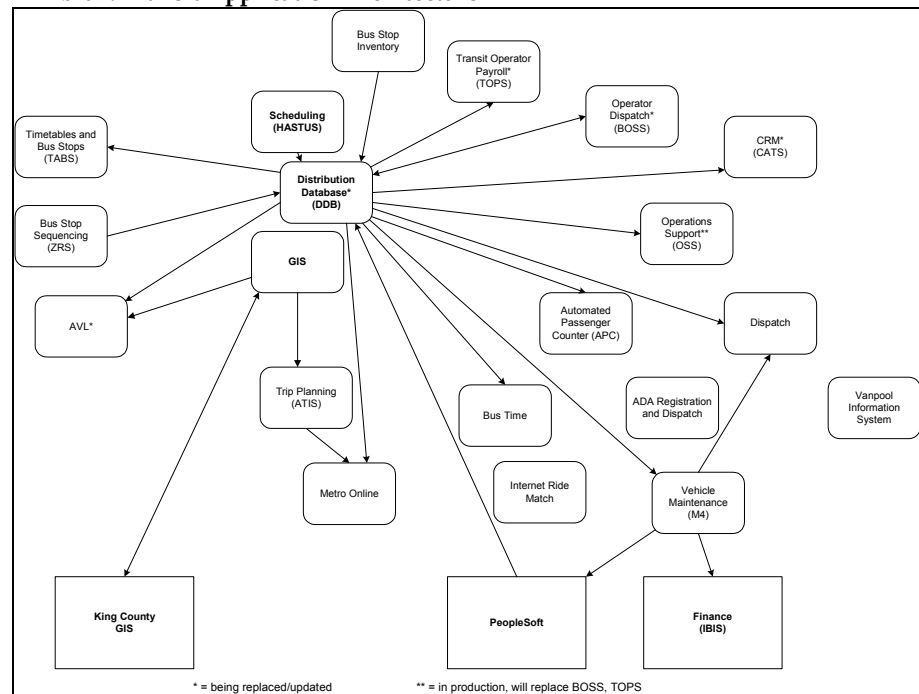
Table 16: Metro Transit Systems

System	Function	Technology
HASTUS	Scheduling/run cutting	NT, Oracle, C++
ZRS	Bus stop sequencing	Windows, Focus
Zones	Bus stop inventory	Windows, Focus
TOPS	Transit Operator Payroll	Mainframe, COBOL
Boss	Bus operator dispatch, timekeeping, work assignment	Prime, QUEO
OSS (Operations Support System)	Replaces BOSS	Unix, Windows, Delphi, Oracle
CATS	Customer Assistance and Comment Tracking System (to be replaced)	Prime, QUEO
Bus Time	Timetable and bus stop data	NT, Oracle, C++
ATIS (ATP)	Automated trip planning	Linux, C, Visual Basic for client server



System	Function	Technology
AVL	Automated vehicle locator	Unix, C, Visual Basic for client server
GIS	Geographic information system	Unix, NT, ESRI, Oracle, VB
M4	Vehicle maintenance system	Unix, NT, Windows, Oracle, Open Road
Vanpool Information System	Multipurpose system for managing vanpool information such as ridership, subscribers, accounting information	Visual basic
Dispatch	Vehicle assignment	Powerbuilder
ADA Registration and Dispatch	Reservations and scheduling of paratransit service	Trapeze
Timetables and Bus Stops (TABS)	Creates timetables and bus stop sign strips	Open Road, Ingres
DDB	Distribution database; supports federal reporting and helps manage interfaces between Transit systems that share data	Unix Oracle
Metro Online	Agency Web site	Web
Internet Ride Match	Ridershare application for the public	Web

Exhibit 7: Transit Application Architecture





- *Roads Services*

The primary systems used by Roads are listed in Table 17; information is limited to that which was submitted. The relationship between these systems is depicted in Exhibit 8, an architecture diagram developed and used by the Roads division.

Roads uses operating systems that are aging rapidly at 20 to 25 years old. These systems include the Accident Data System and Road Network Inventory. The dated systems have been primarily written in COBOL by internal programmers and require extensive maintenance. While the Roads technology staff are capable of maintaining such systems, some concerns exist related to the few number of personnel who know the programming code. Another system of concern is the Maintenance Management System (MMS). The MMS is written in micro COBOL, which is considered a nonstandard language and requires attention from a third or more of an FTE to ensure that routine maintenance is completed. The Roads systems are becoming increasingly unable to meet the needs of the division, particularly for data sharing. There is also some risk that a systems failure would consume an excessive amount of time to bring the systems back to operational status. The strengths of these systems include being well understood by users and the available functionality developed specific to the needs of the County.

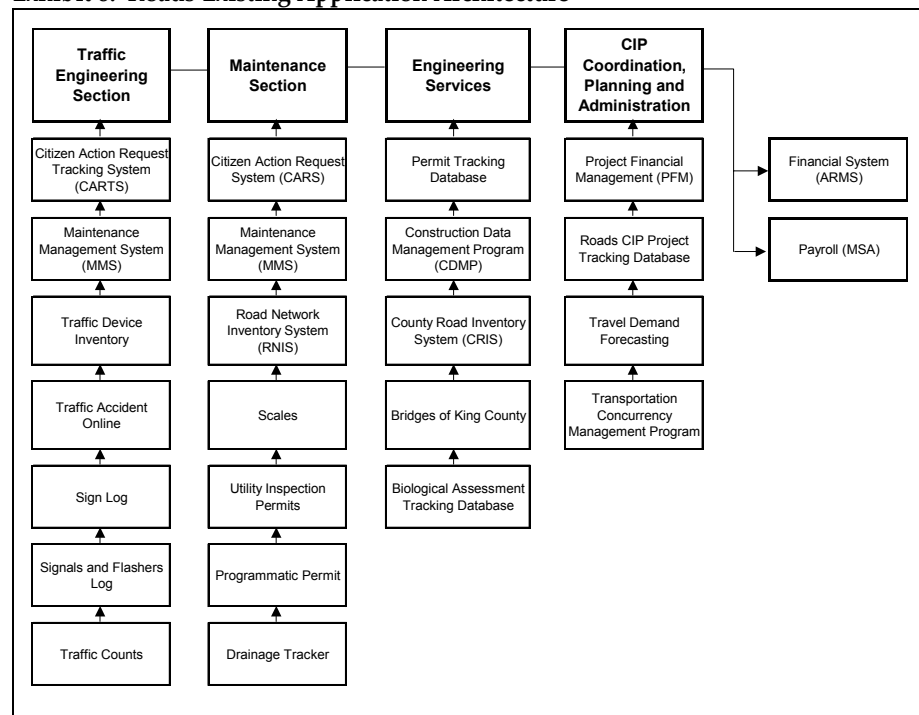
Table 17: Roads Systems

Application Name	Functions
Project Financial Management (PFM)	Procurement/Financial Management Division-wide database program to track revenues and expenditures
CARTS	Customer action request tracking system tracks requests and CCF data and activities
Traffic Accident Online	Tracks long-term traffic accident information
Traffic Device Inventory	Tracks long-term historical information for signs and thermoplastic
Signals and Flashers	Tracks the maintenance, operations, and installation schedule for signals and flashers
MMS — Maintenance Management System	Tracking annual maintenance program for traffic control devices, new construction, and discretionary services
Signs (Sign Log)	Application to track the installation and maintenance activity for signs and thermoplastic
Citizen Action Request	Citizen action request tracking system
Scales	Provides information on road waste material, etc., that is recycled or disposed of



Application Name	Functions
Drainage Tracker	Provides information on project numbers and drainage complaints
Programmatic Permit	Provides information on projects that DDES staff are interested in
Utility Inspection Permits	Keeps track of permits and work done by utilities on the right-of-way
Permit Tracking Data Base	Data associated with project permits
Biological Assessment Tracking Database	Data associated with project permits
Bridges of King County	Bridge inventory data and work-order data
County Road Inventory System	Inventory of county roads (Pavement Management System)
Travel Demand Forecasting	Traffic volumes, vehicle miles traveled, etc.
Transportation Concurrency Management (TCM)	Level of service standards status
Roads CIP Project Tracking Database	Construction, financial, scope, and administrative status of Roads CIP projects
Construction Documentation Management Program	Construction data
Road Network (RNIS) Inventory System	Detailed roadway inventory

Exhibit 8: Roads Existing Application Architecture





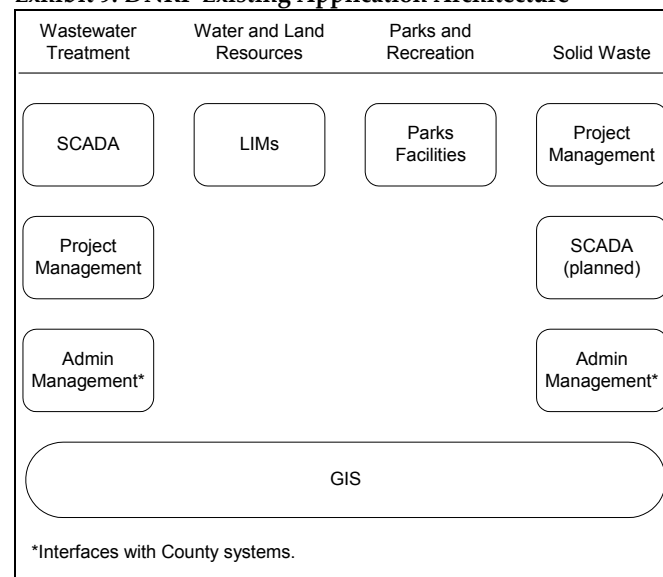
(iv) Department of Natural Resources and Parks (DNRP)

The DNRP operates a variety of network-based and stand-alone applications. While most applications are relatively small, some larger applications are operating within the GIS Center and at the Treatment Plant. Smaller applications run on Microsoft Windows and Apple Macintosh systems. Most of DNRP's systems are considered to be operating satisfactorily. To support such systems DNRP hopes to upgrade NT servers and workstations to move to the Windows 2000 environment, and at the same time to take advantage of expected enhancements to the Countywide WAN. Continued operation and incremental extensions to the current Windows-based network will likely provide satisfactory services into the foreseeable future. Access users are also planning upgrades to more current versions of the software at some point in the future. The department also conducts business with numerous external partners such as the University of Washington, and as such, DNRP share data with its business partners. DNRP applications are identified in Table 18 below and depicted in Exhibit 9.

Table 18: DNRP Applications

Application	Function	Platform
Supervisory Control and Data Acquisition Systems (SCADA)	Monitors and controls treatment plants.	VAX VMS
Laboratory Information Systems (LIMS)	Monitors water quality.	Windows NT
GIS Geographic Information Systems	Records, analyzes, and reports land information.	Unix/Windows
Parks Facilities	Supports recreation programs.	Windows
Project Management	Manages capital projects.	Windows
Administrative Management	Interfaces to ARMS, IBIS, PeopleSoft.	Windows

Exhibit 9: DNRP Existing Application Architecture





(v) *Department of Assessments*

Mainframe applications comprise most of the major “administrative” functions that support the Assessor. These applications contain the same core data elements that are utilized by the Finance Department for the tax billing and collections processes. Any failure of the system would be serious for both departments. The mainframe applications require significant ongoing maintenance to keep up with changes mandated by the legislature and the County’s business. However, conducting maintenance is challenging because of the age of the application suite and the limited number of staff available to support it. Department management is well aware of this situation and has assigned five staff to the task of migrating applications away from the mainframe. This effort is concentrating on moving applications to the SQL server environment.

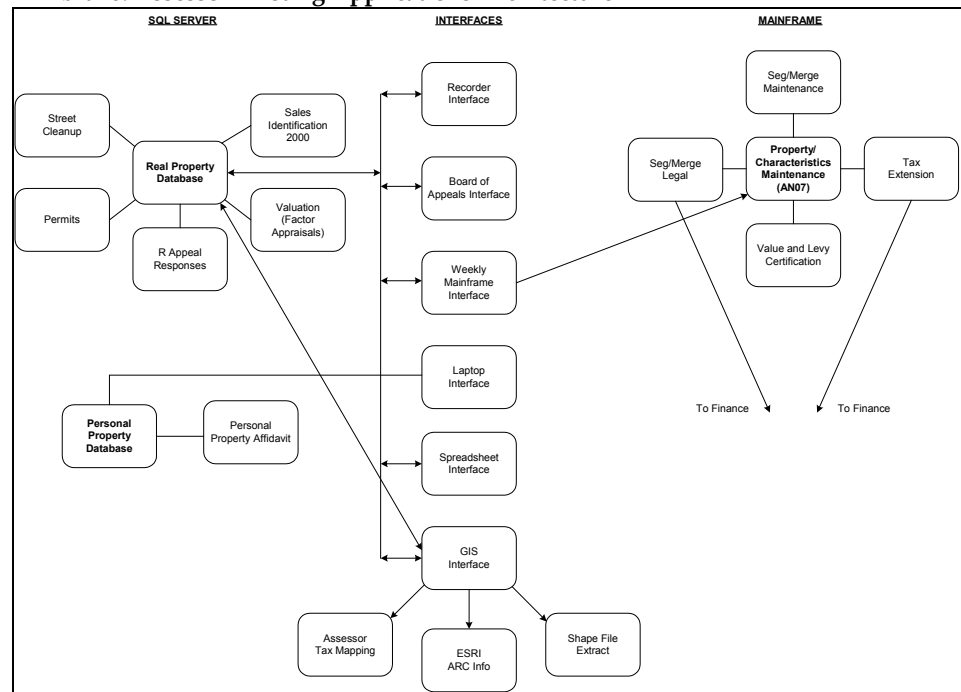
From a technical architecture perspective, the segregation of the assessment applications across two hardware platforms requires the business unit to run multiple updates to both sets of databases on a weekly basis. The update process is required in order to keep the two databases synchronized. The process is time consuming and raises the possibility of error. Running multiple hardware platforms also requires additional staff with different skill sets to support the different architectures. Additional Assessor applications have been developed using Microsoft software products, including SQL server, Visual Basic, and Excel. Applications are listed in Table 19 and illustrated in Exhibit 10.

Table 19: Department of Assessments Applications

Application	Function	Platform
AN07	Property characteristics maintenance	Mainframe
ATC001	Seg/merge maintenance	Mainframe
ATC240	Seg/merge legal description maintenance	Mainframe
Street Cleanup	Correct and maintain street names	Client-Server
Real Property	View or update property information	Client-Server
Personal Property	Update personal property accounts	Client-Server
Permit Activity	Enter permits	Client-Server
Personal Property Affidavit	Print GEO and leased affidavits	Client-Server
Sales Identification 2000	Identify parcels to sales	Client-Server
R Appeal Response	Respond to residential appeals; view comparable sales	Client Server
ASC001-ASC720	Tax levy and certification	Mainframe
SC and TR Series Systems	Tax extension	Mainframe
Factor Appraisals	Adjust residential values	Client-Server



Exhibit 10: Assessor Existing Applications Architecture



(vi) Additional Legacy Systems

Many other agencies utilize legacy systems. Table 20 provides a partial listing of the County's applications that have been reported as part of this study:

Table 20: Agency Legacy Systems

Agency	System(s)	Function	Database	Programming Language
Adult and Juvenile Detention	Roster Management System	Staff scheduling, payroll, personnel, etc.		Clipper 5.3b
DOT – Roads Services Division	Traffic Device Inventory	Track long-term historical information for signs and thermoplastic in support of inventory and maintenance activities	Mainframe	COBOL
DOT – Roads Services Division	Public Works Purchasing System	Track expenditures for projects, tasks, and organizations	Mainframe	
Information and Administrative Services	Animal Control Complaint/Dispatch Tracking	Manage and process complaints about animals	ADABAS	Natural



Agency	System(s)	Function	Database	Programming Language
Information and Administrative Services	ITS Billing System	Produce billings of ITS customers for analyst and computer resources	VSAM	COBOL
Information and Administrative Services	Business License System	Issue, renew, and manage business licenses	ADABAS	NATURAL
Information and Administrative Services	Master Street Address Guide	Identify location addresses and assign them to emergency service providers	ADABAS	Natural/ADABAS
Information and Administrative Services	Pet License System	Manage and process pet licensing	ADABAS	NATURAL and Microsoft C
Information and Administrative Services	Rate Determination System	Develop analyst and computer resources billing rates		SAS, Lotus 123
Information and Administrative Services	Telephone Billing System	Produce billings for telephony-related resources and services	ADABAS	Natural
Information and Administrative Services	Vote Management System (Voter Registration System)	Manage and process registered voters	ADABAS	NATURAL

These legacy systems are generally outdated, difficult to maintain, and are becoming more fragile in terms of stability and reliability.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Systems supplied by third parties are specifically designed to provide unique agency business functionality. ✓ There is a group of users in counterpart agencies located at other counties in the state and nation. ✓ When used, third-party application providers provide solutions that are installed at other sites and provide support for such applications. ✓ Systems have been developed directly to meet the needs of end-users. ✓ End-user knowledge is high regarding systems' functionality. ✓ Systems are well understood by the existing users. ✓ Current systems were developed to meet particular needs of the County. ✓ Many of the systems are designed to support processing of a large number of transactions. ✓ There are minimal hardware and infrastructure requirements associated with keeping these systems up and running. ✓ The supporting mainframe operates reliably and efficiently. ✓ Current systems appear stable enough to run into the foreseeable future.
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<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ A lack of plan for software in general.✓ No data management plan.✓ Legacy architecture staff knowledge capital loss.✓ A lack of staffing plan to maintain systems.✓ A lack of plan related to maintaining legacy systems.✓ A lack of phase-out strategy for legacy systems.✓ A lack of integrated strategy between enterprise and legacy systems.✓ A lack of middleware.✓ A lack of application portfolio.✓ Obsolescence of legacy technology.✓ Few staff are currently available to support aging software systems.✓ Different standards and designs have been used over the years related to database design and functionality.✓ Supporting documentation is often limited and out of date.✓ Up-to-date data models do not exist to support many applications.✓ System maintenance has not occurred consistently.✓ Software changes are often difficult to make and are expensive.✓ There are concerns about the long-term stability as software ages and is not updated.✓ The user interface is not intuitive in contrast to graphical user interfaces.✓ System upgrade options are limited by older software designs and architecture.✓ Whenever redesign occurs, it is expensive.✓ County programmers supporting some systems (including LS&J) are retiring soon; availability of skilled mainframe programmers is being questioned.
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D. Management and Organization

Management is how technology resources, including staff, are managed. Organization includes structure, defined positions, and staffing levels. Several areas related to management and organization are considered to have strategic implications. Weaknesses of particular concern include lack of the following:

- Formal performance measurement, which hinders agencies from knowing where plans, initiatives, projects, and budgets stand during implementation and afterwards
- Designs and plans to guide personnel in development, implementation, and deployment activities
- Project management capabilities
- Centralized, coordinated organization structure supporting enterprise functions and technologies
- Leadership, analytical, and project management skills focusing on the “business side” of technology deployment

Related management and organization discussion is also found in the Service Delivery section of the assessment under Support/Help Desk, and Outsourcing; in Operations under Asset Management; in Architecture under Network and Applications (e.g., GIS); and Funding under Planning for Expenditures.



D1. Training

The training provided to end-users is structured to increase skill sets for the purpose of bringing user capabilities up-to-date with available technologies and ultimately to increase productivity. Training at the County is a decentralized function. Agencies generally take care of their own requirements, which are addressed primarily on an as-needed basis.

Overall, training is delivered through a variety of venues, including conferences, workshops, and classroom sessions.

Findings:
<ul style="list-style-type: none"> – Functions lack global management and coordination. – Technology Learning Center facility is in operation. – Most users are on their own to find help. – Significant opportunity exists to strengthen use of funds.

Technology training was frequently noted by agency managers as an area of concern throughout this study. While agencies have the latitude to select and train staff as needed, they do not have clear guidelines regarding what curriculum to pursue or how to expend resources. Several agencies stated that training is delivered on an “ad hoc” basis. Agency managers spoke directly to the need for “centralized training standards.” Other managers noted needs for more technology knowledge transfer. The scope of existing training efforts for technology staff and end-users is depicted in Table 21 (for those agencies that reported in during the process).

Table 21: Agency Training

Agency	On-Site County Workshops	On-Site Vendor Workshops	Off-Site with Agency Partners	Off-Site Training
Human Resource Management	T, U	T, U		T, U
Adult and Juvenile Detention	U	T, U	U	
Natural Resources and Parks	T, U	T, U		T, U
Judicial Administration	T, U	T		T
Airport Division	T, U		T, U	T, U
District Court	T, U		T	
Fleet Administration	T, U	T, U	U	T, U
Road Services	T, U	T, U	T, U	T
Metro Transit	T, U	T, U		T, U
Prosecutor	T, U	T, U		T
Public Health	T	T		U
Finance	T, U	T, U		T, U
Development and Environmental Services	T			T, U
Information and Administrative Services	T, U	T, U	T, U	T, U
Superior Court		T	T	T, U
Sheriff's Office	T, U	T		T, U

T = Technical Staff U = End-Users



Generally, the majority of agencies do not allocate specific funds for technology training. Of those that do, the amount specified per employee was mostly minimal. For example, the Airport, Road Services, and the Sheriff's Office budget in the \$100 – \$400 range per employee per year.

A serious weakness in the County's training program is that while there appears to be adequate training for many of the existing platforms and applications currently in use, these systems are nearing the end of their functional lives. The result being that a number of staff are trained on technologies that are nearly obsolete. The County generally has a skilled workforce but not in the technology that it requires to move to the next level of efficiency and cost-effective performance. An enhanced web-based presence and business information exchange model will require greater training in web development, relational databases, SQL server and the management of such projects. This particular limitation is addressed in the strategies related to enhanced project management and leadership as well as utilization of the Digital Academy.

From a facilities standpoint, the County operates a centralized training center located in ITS. The center is available for use at a rate of \$300 per day. Availability has been reported as an issue because of the limited size of the center. In addition, the GIS Center includes training as part of its mission. GIS training resources include a certified training instructor, a training facility, and established training curricula used for County staff and personnel from other outside governmental agencies.

Additional training resources tapped include outside training partners. For example, Netdesk, an external third-party training organization, is utilized for both on-site and off-site training. Netdesk provides ITS with Microsoft certification classes on Microsoft products. Classes are provided to technical staff throughout the County. ITS' Technology and Operations section purchases training segments from Netdesk directly.

- | | |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Strengths:</i> | <ul style="list-style-type: none">✓ Agencies have the flexibility to address their own training needs.✓ The County operates a Technology Learning Center. |
| <i>Weaknesses:</i> | <ul style="list-style-type: none">✓ Training is managed tactically versus strategically.✓ There is limited crosstraining between agencies.✓ Limited formal funding is provided.✓ Employees are often on their own to find help.✓ Training is not geared towards future technologies the County needs to implement. |



D2. Centralized versus Decentralized Structure

County agencies manage and operate technologies centrally in some cases, and decentrally in others. While this hybrid form of management is common in large governmental organizations, it leads to some complexities, including a lack of standardized architecture. The centralized agencies providing services to others include ITS, DNR GIS, and Finance. Decentralized agencies taking care of their own business (to varying degrees) include Transit, Sheriff, Public Health, DDES, and DNRP.

Findings:
– The County’s technology organization operates as a hybrid: part centralized and part decentralized.
– Agencies with decentralized technology operations tend to be larger and better funded.
– Decentralized agencies often operate separate, redundant, and overlapping functions.

There is no consistent organizational model in use at the County related to how technology is managed. This is because technology groups have evolved in an ad hoc manner from small desktop and LAN support groups into larger application support groups. These teams have also evolved at different rates. The trend over the last ten years has been towards a decentralized technology management structure.

Table 22 provides a listing of the technology groups that are in operation today at the County.

Table 22: Technology Groups in King County

Agencies of King County Government	IT Staff
Dept. of Adult and Juvenile Detention (DAJD)	6
Dept. of Assessments (DOA)	11
Dept. of Community and Human Services (DCHS)	1
Dept. of Development and Environmental Services (DDES)	10
Dept. of Executive Services (DES)	
Information Telecommunications Services Division	178
Finance & Business Operations Division	?
Human Resource Division	6
Dept. of Judicial Administration (DJA)	6
Dept. of Natural Resources and Parks (DNRP)	30
Dept. of Public Health (DPH)	26
Dept. of Transportation (DOT)	
Metro Transit Division	51
Road Services Division	9
Fleet Administration Division	2
King County Council (KCC)	2
King County District Court (KCDC)	?
King County Sheriff’s Office (SHERIFF)	14
King County Superior Court (KCSC)	8
Office of Information Resource Management (OIRM)	8
Prosecuting Attorney Office (PAO)	10
TOTAL	378



This representation was developed from information received during interviews and from surveys and is not a complete picture of all technology staff resources. Staffing numbers include both management and staff. The shaded items are technology groups who have a portion of their technology staff who support enterprise IT functions in addition to specific agency/departmental systems responsibilities:

- Information Telecommunications Services Division have Network Infrastructure, Communications, Finance and HR/Payroll systems;
- Finance & Business Operations Division have Fixed Assets, Finance and HR/Payroll systems;
- Human Resource Division have HR systems;
- Dept. of Natural Resources and Parks have major components for GIS;
- Office of Information Resource Management responsible for technology governance.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ To date centralized and decentralized agencies have coexisted for some time.✓ Larger agencies have been able to manage and take care of their own technologies.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Because agencies have evolved independently, there is some overlap in services being provided.✓ Very little top-down planning has occurred within the County to establish an optimum organizational model, balancing what is delivered centrally and decentrally.

D3. Leadership and Management

In the past, technology leadership has been mostly provided decentrally by the managers located within each agency. For the most part, leadership has been provided by administrative and technical managers through the course of everyday business. In some cases, there has been a noticeable lack of attention and direction given to technology. This is evident through the lack of formal strategies, plans, and the time spent moving agencies' computing environments forward.

Findings:
<ul style="list-style-type: none">– Technology leadership has been mostly provided decentrally throughout the County.– Significant focus has been on maintaining the status quo.– Day-to-day management is active regarding operations and projects.– There is a correlation between the size of agency and amount of management occurring.

In contrast to the limited amount of strategic attention, day-to-day management has been more active. Generally, the focus of management has been on maintaining the status quo through systems operations and project implementation. There is a noticeable correlation between the size of an agency and the amount of management taking place. Agency technology management is being provided at both business and technical levels. The dual levels of management are reflected in the types of personnel participating on the Business Management Council (BMC) and Technology Management Board (TMB).



Within larger technology departments, management is segregated by area of specialty. In ITS, for example, managers are assigned to network and systems operations, technology services, applications development and systems support, finance systems and services, and printing and graphic arts functions. In other agencies, there are also managers assigned to oversee technology departments. Often these managers are supported by lead technicians providing support in technical areas such as networking and programming. As identified in the staffing inventory conducted as part of this study, technology manager positions exist in the Department of Adult and Juvenile Detention, Judicial Administration, Public Health, Metro Transit, Road's Services Division, Assessments, GIS Center, District Court, and Department of Natural Resources. Additionally, many of the supervisors, leads, and network administrators conduct management activities as part of their day-to-day responsibilities.

Currently, technology leadership and management within the County is undergoing a change process. With the recent change in the governance process and the establishment of the Office of Information Resource Management, more attention is being paid to strategic issues. With regard to management, improvements are underway related to planning, control, and monitoring.

From a project management standpoint, the County lacks comprehensive resources to ensure that successful outcomes are always achieved. Currently, personnel attend to core activities, including managing tasks, budgets, schedules, and deliverables. While project managers are doing their best to address the basics, more sophisticated project management techniques are not always in place. Particularly lacking is a standard management framework that includes ongoing training, reporting, oversight, established methodologies, and skilled and experienced personnel.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ Managers are assigned to oversee technology operations for those agencies that have functions in-house.✓ Day-to-day organization, control, and monitoring functions are occurring at satisfactory levels.✓ Focus has been on maintaining viable operating environments and systems.✓ Project managers are addressing basic needs.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Strategic planning has been lacking within the agencies.✓ Enterprisewide coordination has been lacking.✓ Focus has been on maintaining the status quo.✓ An advanced project management framework is not in place.✓ Standards are missing.



D4. Staffing

Staff counts reported during this study provide an indicator of the size and scope of agency technology operations. Nineteen technology groups are spread throughout the County, ranging in size from 1- and 2-person groups located in the DCHS office of Public Defense and in the Fleet

Administration Division to 178 in ITS. Sizeable groups exist in the Department of Assessments (11), Department of Natural Resources and Parks (30), Prosecuting Attorney's Office (10), Metro Transit Division (51), Public Health (26), and the Sheriff's Office (14). Other technology staff reside in other places such as the Counts, Assessor's Office, legislative branch, etc. The staffing inventory recorded most positions as being technical in nature, with the majority of position titles defined as network administrator/engineer, PC support/coordinator/ analysis, and help desk support.

Findings:
<ul style="list-style-type: none">– Resources are stretched but mostly adequate at current levels.– Many personnel are technically sound.– Project management and analytical skills are lacking.

Staff roles and responsibilities are depicted in Table 23 for those agencies that provided an overview of staff functions.

Table 23: Representative Agency Technology Staff Positions

Agency	Staff Roles/Responsibilities
Public Health	<ul style="list-style-type: none">• Managers/supervisors• Help desk technicians• PC support staff• LAN administrators• Application support and development
DOT – Transit	<ul style="list-style-type: none">• Server support• Desktop support• Database administration• Transportation network support• Application support
DOT – Roads Services	<ul style="list-style-type: none">• LAN administration• PC coordination• Computer technology specialists

The larger agency groups also maintain higher-skill positions including programmers/analysts, database administrators, GIS programmers/technicians, and applications support leads. While staffing levels appear to be stretched, personnel appear to be getting the day-to-day job done. The most significant challenge appears to be in ITS, where demands are reportedly “outstripping resources.” Pending budget cuts are expected to exacerbate this problem. Generally, skill levels across the County appear adequate to operate existing technologies but require improvement in leadership, analysis, and project management. Similarly, personnel seem to be struggling to maintain up-to-date knowledge and skills with regard to newer technologies that are being implemented and on the horizon.



<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Commitment among staff is strong, especially toward fulfilling the agency mission. ✓ Existing staff are able to meet agencies' most pressing demands. ✓ Many staff have sound technical skills regarding current technologies. ✓ Staff appear to know their assigned jobs well.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ Project management and analytical skills are lacking. ✓ Staffing levels appear stretched.

D5. Governance/Oversight

In response to Council and Executive direction, a top-down governance process was established through legislation in December 2000. At that time, the County established a new CIO position and the Office of Information Resource Management (OIRM). The improved governance structure was strengthened in

July 2001 and has been set up to increase oversight within the County. Several new groups have been established to support the governance effort, including the Strategic Advisory Council, Business Management Council, Technical Management Board, and the Project Review Board. As of winter 2002, these committees are operational and beginning to fulfill their charters. Other ad hoc committees are also being utilized to address particularly current issues the County needs to deal with (e.g., security). The new governance structure has not been operating long enough to test its performance.

Findings:
<ul style="list-style-type: none"> – Beginning to strengthen accountability around County. – Newly established CIO position. – Governance being achieved through a participatory committee process involving the SAC, BMC, TMB, and PRB.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Efforts are underway to strengthen accountability. ✓ A new CIO position has been established to provide overall Countywide leadership. ✓ Supporting committees are being established to conduct further analysis in specific areas in need of attention.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ The new structure is new and has yet to be fully tested. ✓ Some confusion exists with regard to how the governance process works. ✓ Some agencies are resisting the new level of oversight.

D6. Span of Control/Chain of Command

Span of control relates to the breadth of management, or more precisely, how many personnel one person oversees. Chain-of-command ties to depth, or how many layers exist within an organization. The span of control within the County's technology groups is fairly large. A rule of thumb in business is that an individual can typically supervise from five to seven people effectively. This number may increase or decrease depending on the type of work conducted and the skill level of staff. The staffing inventory conducted as part of this study determined that managers and supervisors

Findings:
<ul style="list-style-type: none"> – Span of control is stretched, contributing to reactive environment. – Chain of command is adequate through the use of supervisor and lead positions.



often oversee six or more personnel, and sometimes over ten. Because of the existing skill levels and clearly defined position responsibilities, the County has effectively increased the span of control, whereby one manager/supervisor is able to oversee a relatively larger number of personnel. The larger span suggests that management attention is spread thin. While the span of control is stretched, the County's structure appears to be working reasonably well. The chain of command appears likewise under control, with a reasonable number of levels existing within the technology organization. The chain of command is held together at the County through supervisor and lead positions. Although County organizational charts are not clear on this issue, it appears that reasonable hierarchies are in place to provide adequate management and maintain viable reporting relationships. In the future, with pending organizational changes and retirements, more attention will be required to manage these functions.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ Department organizational configurations have been mostly stable, yielding consistent performance.✓ Management has been able to get the daily job done.✓ Reporting relationships appear to be intact and working adequately.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Because of the high number of staff, management is stretched.✓ Organizational configuration does not allow management much time to be proactive, and as a result management is often relegated to operating in crisis mode.✓ Routine situations arise when management overdelegates, leaving staff to their own devices to get the job done.

D7. Privacy Management

Privacy is an area that is clearly recognized as being important to the County. Privacy management relates to the way personal information is maintained in systems and kept confidential. Privacy protection is provided to employees as well as external parties including the public and business partners. Agencies appear to be doing a

respectable job managing sensitive data. Internally, for example, the Human Resources and Payroll personnel have long protected personal information. Externally, groups such as Public Health are also protecting personal data, in, for example, the client-tracking system. Privacy appears to be protected at an appropriate level throughout the County, including within the Sheriff's Office, Prosecutor, Courts, and in Finance, where a lot of personal data are handled. The laws surrounding privacy are well known and include acts such as the Public Right to Privacy Act and the Health Insurance Portability and Accountability Act (HIPAA) of 1996, which mandates strict rules regarding patient privacy, coding, and access to records.

Findings:
<ul style="list-style-type: none">– With the rise of the Internet, privacy protection has become a more important issue.– To date, privacy protection has been generally managed adequately.– Privacy is being actively managed to protect different types of data maintained within the agencies.



The introduction of Internet technologies has added to the complexity of managing privacy. With the explosive use of the Internet, privacy protection has now become a mainstream issue that raises direct concerns about how information is disseminated. The Internet has established beneficial new ways of accessing information, but along with increased access there is also an increased risk of inappropriate use of the same information.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ County efforts are now underway to strengthen privacy controls. ✓ Agencies have managed to protect the County without noticeable incident to date. ✓ There is a fair amount of knowledge within the County to assess and implement most forms of privacy protection.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ No one party is currently assigned the responsibility to oversee privacy at an enterprise level. ✓ The systems protecting the County are piecemeal, underperforming, and fragmented.

D8. Standards

The process of setting technology standards has not been a priority function at the County. Some sporadic attempts have been made to set standards, primarily at the agency level. Efforts have occurred in the areas of PC acquisition and maintenance, data management, Web development, security, and wide area network operations.

Some of these efforts have resulted in substantial documentation being developed, but with little subsequent use. There are few formal, up-to-date standards in effect today, and virtually no enterprise-level standards to guide technology personnel.

Specifically, standards are missing in the critical areas of telephony, equipment acquisition and maintenance, training, disaster recovery, project management, communications protocols, application development, and support. Some recent momentum has been building to promote standards for PC desktops and databases. With the new technology governance process in place, standards are being recognized as being critical to operate the County technologies efficiently and are assumed to be mandatory for enterprise applications.

Given the rate of technological change, standards require frequent review and updates to remain current and useful. For example, standards for PCs and hardware require annual updates. Similarly, standards for operating systems and software must be actively managed to allow for proper maintenance and upgrades to ensure that technology life cycles are optimized and that financial payback occurs. For this reason, standards development is considered to be a critical part of the asset management function that is yet to be developed at the County.

Findings:
<ul style="list-style-type: none"> – A lot of work is needed in the area of standards. – Standards should be decided before significant work is done in systems design and implementation. – Standards are a critical part of an asset management function.



<i>Strengths:</i>	<ul style="list-style-type: none">✓ The recently established governance process has set in motion a means to establish standards.✓ County personnel are beginning to recognize the need for standards.✓ It is anticipated that standards development will occur soon and help guide future decision making.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ There is no detailed uniform methodology in place to establish standards.✓ As of yet, there are few enterprise-level standards available to guide agencies in their efforts.✓ Critical standards are missing in the areas of architecture, service delivery, operations, and management.

D9. Planning

Agency planning has been accomplished on two levels: strategic and tactical. While some agencies have attempted to plan strategically, most of the plans are largely tactical in nature. Generally, agencies have had neither the leadership to drive the process, nor the expertise, time, or resources to spend in analysis or development efforts.

Some plans that have been developed have not been fully implemented. Over the years, several plans have been developed to set strategic direction. ITS has led the central planning efforts. These efforts have resulted in development of the following:

1. *Information Technology Strategic Plan*
Phase 1: Version 1.1, August 15, 2000
2. *Report on King County Information Technology Strategic Planning*, October 1999
3. *King County Information Technology Strategic Plan*
August 1995

Although these plans were not formally adopted by the County Council, each included some respectable analysis. Several of the key recommendations resulting from the plans were eventually implemented. These plans also laid the foundation for future planning and systems development. Some of the basic components missing in past planning efforts include strategies with action plans and related budgets.

Beyond a few past strategic planning projects, detailed plans have been mostly lacking, especially regarding agency initiatives, changes in architecture, and large projects. In particular, designs that support the network, applications, database architectures, etc., are conspicuously absent. Similarly, action plans and corresponding budgets components are also noticeably missing.

Findings:
<ul style="list-style-type: none">– This is often viewed as an unimportant function.– Planning is missing both strategically and tactically.– ITS has made efforts over the years to address issue.– Staff are not well trained in this area.



For the most part, in cases in which planning has occurred, it has been addressed on a project-by-project basis. In general, non-CX agencies such as the Department of Natural Resources (DNRP), Department of Transportation (DOT), and Public Health have access to outside funds and additional resources, and as a result conduct planning periodically. Partially because of the grant-funded opportunities and grants-application processes, they are more involved in planning activities than other agencies. Transit is an example of one agency that conducts planning at reasonable levels. With access to dedicated funding, Transit conducts regular multiyear capital planning. Another example of where personnel are increasingly recognizing the need to plan is within the Law, Safety, and Justice arena. LS&J agencies are currently engaged in a major systems review project, targeted at workflow integration. In addition, the Sheriff's Office recently contracted with an external consulting firm to develop a strategic technology plan, which was completed early in the first quarter of 2002.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Some agencies (primarily non-CX) have developed plans over the years. ✓ Planning is recognized as necessary to support the annual budgeting process. ✓ ITS has initiated several planning efforts over the years that have yielded important analysis.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ Both strategic and tactical plans are lacking. ✓ Staff are not well trained to conduct planning. ✓ Smaller CX agencies are the least likely to plan on a regular basis.

D10. Business Analysis

County personnel currently conduct business analysis at modest levels. Analysis involves evaluating business processes, requirements definition, modeling, design, and alternatives review. Agencies approach analysis differently, using various methodologies. The methodologies used include assessing and

improving existing processes, matching processes with automated systems, and improving the design and selection of computer systems. Other important components of business analysis include cost/benefit analysis, market assessment, prioritization, and understanding end-user needs. These latter components are typically not addressed in great depth. Some agencies conduct analysis fairly regularly to make certain types of system decisions. For example, analysis has preceded changes to Oracle/PeopleSoft reporting, GIS, Transit, and LS&J applications. In cases where proper analysis has not been completed, projects have sometimes stalled or resulted in an inappropriate outcome. A primary example of a past challenge related to business analysis is the difficulty agencies have had reaching consensus on business requirements related to integration approach.

Findings:
<ul style="list-style-type: none"> – Few personnel have formal training or experience to conduct business analysis. – Challenge of aligning business processes to technology is significant. – Staff are often trained to address technologies rather than business needs and workflow.



The importance of conducting proper analysis should be considered significant. Analysis directly impacts the way business is conducted within and between agencies. From a technology standpoint, few personnel have extensive formal training or the experience to conduct in-depth business analysis. Representative areas in which further analysis is required are in the areas of Budgeting, Procurement, Human Resources/Payroll, Finance/Accounting, and within Law, Safety, and Justice. The lack of analysis heavily contributed to the past failure of the ERP implementation, and if not directly addressed, will again significantly impact future projects and increase the potential risks within projects. The need for strengthened analysis is not well understood among staff; and while managers often have a notion that this is an important area, executive management has yet to fully recognize the importance of this issue.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ The County conducts systems requirements definition as a routine part of development efforts.✓ Various methodologies are in use, indicating that some level of evaluation is occurring.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Business analysis is not performed across agencies where it could be used to promote cross-agency system efficiencies.✓ Business analysis and modeling are not occurring at sufficient levels to adequately support decision-making processes.✓ Risk analysis is often left completely out of the picture.✓ Formal training has not been obtained.

D11. Telecommunications

Telecommunications management includes overseeing the functions associated with delivering telecommunications services. Functions range from project management to installing and testing systems. Other work involves performing moves, adds, and changes as well as maintenance of systems and infrastructure.

Findings:
<ul style="list-style-type: none">– Systems are disaggregated.– Requires an integrated design.– There is long-term potential for quantifiable benefits if managed properly.

Within the County, telecommunication requirements have evolved along with the County's business model and technical capabilities. For example, when the County and Metro merged in 1996, management changed significantly because of the need to operate multiple dissimilar phone systems. As in other areas of technology, telecommunications management is shared among the agencies involved. This hybrid approach has resulted in an overall telecommunications management structure that is fragmented and often uncoordinated. While individual agencies have devoted substantial resources to telecommunications operations, agency efforts are still disparate and not orchestrated according to a Countywide set of standards, policies, or operational controls.



As it stands now, agencies autonomously specify the classes of voice services applicable to individual employee positions. Each agency has an assigned staff person responsible for telecommunications. However, agency functions are generally not formally defined or documented. Assigned employees are on their own to filter and coordinate changes, add or remove services, and make repair calls.

Similarly, the information maintained about each telecommunication system varies by agency as well. As a result, the separate telecommunications databases do not provide the information necessary to support effective operations management. For example, existing databases do not specify the location of Public Switched Telephone Network (PSTN) facilities within a given building, or designate the fire and security alarm circuits that are in place. Because each agency controls so much of its telecommunications infrastructure, budgets/expenditures are managed at the agency level. While this makes sense under a decentralized model, it impedes the ability to set and enforce standards and manage services consistently from an enterprise perspective.

Centrally, the Distributed Computing Section (DCS) of ITS has the responsibility for managing telecommunications networks and providing services to the desktop to over 100 locations. Service orders are routed through DCS, and system changes are made according to defined operations standards. To support this model, ITS has established station-level user pricing as a way of allocating voice telephone services costs to agencies. Such pricing allows for flexibility in making subsequent adjustments based on any system reconfigurations or changes in equipment ownership. Additional support services are outsourced under maintenance contracts with Qwest, NetVersant, and Verizon.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ There is a clear intention within the Distributed Computing Section of ITS to improve operations system and services.✓ Station-level user pricing enables flexibility for adjustments in systems configuration and ownership.✓ Although the Distributed Computing Section has identified critical problems and operations needs, its customers are still generally satisfied.✓ The County-operated Public Safety Answering Point (PSAP) has experienced Nortel-trained telecom coordination that works well.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Telecommunications management is generally fragmented around the County.✓ Disparate telecommunications systems databases do not provide complete information essential for operations management.✓ Services are not managed consistently or from an enterprise perspective.✓ Telecommunications policies and procedures are not well developed or documented.



D12. ITS Organization

ITS is the County's centralized technical service group, with over 150 employees operating out of the 16th, 18th, 23rd, and 24th floors at Key Tower. The organization is primarily structured around six groups:

Network and System Services operates and maintains the wide area network at over 215 sites throughout the County and provides systems administration for hosted applications. This group was reorganized in January 2002 to become more streamlined and includes about 36 FTEs. Group functions include network engineering, administration, managing the network operating center, and systems engineering.

Operations primarily runs the data center housing the mainframe and colocated servers. Group functions include scheduling, production control, and data entry. Approximately 26 FTEs support this group.

Technology Services provides LAN support for several County organizations and Countywide messaging and telecommunications functions. This group includes about 23 FTEs concentrating on physical systems that support agencies' distributed environments.

Applications Development and Systems Support focuses on supporting major legacy software systems, including Law, Safety, and Justice, and small platforms as well. The Web team is a key part of this group. Group functions include development, integration, and maintenance of approximately 150 systems, about equally split between the mainframe and distributed systems. The overall group consists of approximately 47 FTEs.

Finance Systems and Services provides basic administrative services to ITS, including procurement, accounting, financial reporting, facilities management, contract management, human resources, and planning and budget functions. Seventeen FTEs support this group.

Printing and Graphic Arts provides printing, high-volume copying, and graphic arts and multimedia services. This group includes approximately 18 FTEs.

Additionally, a customer service function is under development. ITS has also recently filled numerous management positions, including the Assistant Manager (1/02), Operations Manager (9/01), and Applications Manager (12/01). As of 1/1/02, ITS is now part of the newly reconfigured Executive Administrative Services agency.

Findings:
<ul style="list-style-type: none">– Personnel are trained well technically, providing a solid technical operations group.– In the past, ITS has been positioned as a technical support group versus “leading-the-way” for the County.– There is a history of reactive support.



During the planning process, significant feedback was obtained from agency end-users related to their dealings with ITS. The feedback is considered important because it affects the relationship between the agencies and also impacts the level of business that may be conducted in the future. Several ITS issues require further attention, including available capabilities to service nonmainframe applications, frequent organizational changes, ongoing procedural changes, interruption of service delivery and/or inconsistent service, staffing levels, and the ability to provide support in a timely fashion.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ ITS is viewed as a valued provider of specific enterprise services, including WAN, e-mail, telecommunications, and Internet hosting. ✓ For a select set of clients, ITS provides continuing support to applications that are running on the County's mainframe. ✓ ITS provides development and continuing support for client-server and browser-based applications. ✓ Upon request and as necessary, ITS will supply term-limited temporary employees (TLTs) or contract technical resources to other agencies to augment staff. ✓ Personnel are well trained technically, particularly in supporting current Operations.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ ITS has done little to advertise its expertise in other than mainframe and enterprise areas. ✓ ITS services have not always been available on a timely basis. ✓ ITS' reputation has been impacted by — <ul style="list-style-type: none"> • A history of focusing on mainframe applications; • A series of organizational changes; • Inconsistent definition of services; • Some inconsistencies in the level of service provided. ✓ A history of reactive support.

E. Funding

Funding includes budgeting and accounting practices, capital financing mechanisms, and charge-back rate models. While some capital projects continue to have reasonable funding levels, the County has not followed up with adequate operational funding to properly maintain technology. An even more basic funding issue is the lack of accounting that exists related to technology. Technology planning, budgeting, and ongoing accounting at the County are considered to be areas of weakness. As a result, the County is not in a position to track the total costs of ownership, conduct proper cost/benefit analysis, or implement meaningful performance measurement systems.

E1. Ongoing Funding

Frequently agencies are building systems and covering capital expenditures, but then are not paying much attention to the issues and costs associated with ongoing operations and maintenance. This approach appears to be driven by the higher relative priority of direct program activities. The lack

Findings:
<ul style="list-style-type: none"> – Capital funding has been provided, while operating funds are often lacking. – Situation is exacerbated within CX agencies. – While some managers knowingly make these decisions, many are unaware of long-term ramifications of underfunding maintenance.



of planning for ongoing funding is particularly noticeable in CX agencies, where maintenance and equipment replacement is often deferred.

Significant capital funding has continued to be made available up through the current year. Additional capital funds have been requested for projects at ITS, DAJD, District Court, Judicial Administration, Transit, Human Services, Finance, Elections, Public Health, OHRM/Finance, and DNRP. 2002 funds requested total over \$22.5 million. While capital funds are being requested outright, future operating funds associated with the same projects are unplanned and are generally expected to be provided out of agency program budgets. Because of the size of some planned projects, some moderate amounts of additional operating funds should be anticipated to be needed to support continued operations and maintenance. The result of unplanned or underbudgeted operating activities has a threefold impact on the County. First, when maintenance is needed, funds are not always available and maintenance activities are sometimes deferred. Second, when maintenance eventually does occur, costs are often higher than they would otherwise be. Third, some of the computer assets that are neglected perform at lower than expected levels and impact end-users' job performance. Many times agency managers knowingly direct funds away from technology. Just as often, however, managers do not recognize what it takes to continue to support technology. While managers intuitively know that maintenance is something that they should pay attention to, the same managers often do not have a good understanding of the impact of long-term underfunding, which often results in the agencies' incurring greater costs in the long run to catch up and repair and/or replace systems.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ Direct service delivery to the public is a funding priority.✓ Capital funds are being requested and provided to further advance the state of technology.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Frequently agencies are not paying enough attention to the issues and costs associated with ongoing operations and maintenance.✓ The result of not planning has a threefold impact. First, when maintenance is needed, funds are not always available. Second, when costs are incurred they are often higher than they should be. Third, computer assets are sometimes neglected.✓ The lack of operating fund availability is particularly apparent in CX agencies.

E2. Planning for Expenditures

Almost every agency developed a business plan to support their 2002 budget requests. The purpose of such plans was to identify core programs and services, including a definition of vision, mission, goals, and related outcome measures. Technology was occasionally discussed within such plans, but the analysis was usually limited. A few agencies also have recently developed technology plans. Agencies' plans include the Sheriff's Office, Wastewater Treatment and Transit. The contents of these technology plans also varies;

Findings:
<ul style="list-style-type: none">– No comprehensive long-term technology budgets are available at either the agency or Countywide levels.– Future estimated expenditures and funding requirements are unknown.



those that have been produced include a definition of pending projects, sometimes supported with budget numbers. Generally, the linkage between agency business and technology plans is lacking. And because technology plans are mostly missing, there is limited strategic and tactical analysis available to identify what agencies are planning in terms of technology projects and budgets. Without such plans and budgets, agencies are not in a position to assess the long-term financial impact on their organizations. Under these circumstances, future Countywide expenditure requirements are unknown.

<i>Strengths:</i>	<ul style="list-style-type: none"> ✓ Most County agencies developed business plans in 2001. ✓ A few agencies also have developed up-to-date technology plans.
<i>Weaknesses:</i>	<ul style="list-style-type: none"> ✓ Occasionally technology was referenced within plans, but the analysis was usually limited. ✓ Overall, the linkage between available business and technology plans is lacking. ✓ There is limited strategic and tactical analysis available defining where the agencies are going in terms of technology. ✓ Very little work related to developing multiyear technology budgets is being done. ✓ There is a lack of a standard approach and format related to plans.

E3. Financing

Until the early 1990s, the County developed and implemented technology on a piecemeal basis. The financing of such technology was also accomplished in pieces and largely absorbed into the agencies' annual program budgets. Beginning in 1993, the County funded technology advancement in larger increments through the use of debt financing. The first wave of change occurred in 1993–94, when the County began to network the agencies together. Bond financing generated around \$11 million during this period. The second large wave occurred around 1996. At this time the County was operating from a technology plan that defined dozens of projects to meet particular agencies' requirements. Bond financing generated in the range of \$32 million and was disbursed to individual agencies to spend on their own projects. The most recent significant round of financing occurred in 1998–99. The purpose of this funding was specifically to address the pending financial system acquisition, election systems acquisition, and Y2K upgrades. In total, County bond financing provided approximately \$95.7 million from 1993 to 2001. Most agencies are funding technology through both operating and CIP budgets; however, exact amounts are unknown, as agencies have not tracked expenditures in detail.

Findings:
<ul style="list-style-type: none"> – Until the early 1990s, the County financed technology change through the normal course of doing business. – Beginning around 1993, the County began to finance technology through the use of debt. – Debt still appears to be the most obvious source of funding to tap in the near future.

The County has chosen a path to fund technology largely through debt financing. Many other governments fund technology on a pay-as-you-go basis and/or through reserves. Some consideration should be given to approaching technology financing through more conservative measures.



<i>Strengths:</i>	<ul style="list-style-type: none">✓ The County funded approximately \$95.7 million from technology bond funds from 1993 to 2001.✓ The County has additional revenue-generating capabilities through its debt capacity.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Historical approach to expenditures does not readily allow for reserve buildup.✓ Budgets and financing requirements for technology are not well documented.

E4. Accounting

Generally, County agencies have done a poor job accounting for their technology expenditures. Particularly lacking is an accounting for specific types or categories of expenditures. Accounting detail is also lacking regarding where funds have been spent. The lack of accounting is not a result

of limitations in existing systems, rather the current approach has its roots in program accounting, which has not been updated to recognize the large increase in technology expenditures that have been spent over the last decade. Because agencies do not track detail, it is not possible to accurately determine how much is being spent or the total cost of ownership (TCO). And because TCO is unknown, the County is not in a position to know whether good investments are being made. Typically governments track more information about technology expenditures than King County does. This information is normally expected to be available with a reasonable level of detail and produced on a timely basis.

Findings:
<ul style="list-style-type: none">– County agencies do not account for technology expenditures at an adequate level of detail.– The County is not in a position to know what its total costs of ownership are related to technology.

<i>Strengths:</i>	<ul style="list-style-type: none">✓ System capabilities exist to track detail should the County desire to do so.
<i>Weaknesses:</i>	<ul style="list-style-type: none">✓ Generally, the County has done a poor job of accounting for technology expenditures.✓ Agencies do not track expenditure detail.✓ Total cost of ownership is not known.✓ Performance measures are largely missing related to expenditures.



E5. Charge-Back Mechanisms

On a regular basis, agencies provide resources and assistance to each other, including in the area of technology. Because of the amount of resources involved, agencies reimburse each other for the cost of such service. The agencies that provide significant assistance include Finance, DNRP, and ITS, among others. Several mechanisms are used to recoup the costs of such service. Mechanisms include direct billings as work is completed and/or at appropriate intervals; internal-service funds where cost bases are used to estimate, track, and obtain reimbursement; and enterprise funds that operate like internal-service funds, but have been established separately to account for revenues collected to support specific services.

Findings:

- The agencies that provide assistance to each other include Finance, DNRP, and ITS, among others.
- Each year rates are recalculated based upon historical experience and expected costs for the next year.
- Charge-back mechanisms have been refined over the years and appear to be working reasonably well.
- Charge-back systems will not resolve any of the County's strategic issues.

Because of the number and different types of services provided between agencies, there are dozens of interfund transfers that occur monthly. The cost-accounting approach used at the County tracks a fair amount of detail, and this approach appears to work well for the County. The underlying philosophy used by agencies for charge-back purposes is to "recover costs fairly." Technology charge-back rates are planned such that one fund will not benefit from another, and that costs will not be billed inappropriately. Many types of service rates are calculated on an annual basis with rates set to recover direct costs plus an overhead factor. Each year most of these rates are recalculated based upon historical experience and the anticipated level of future service to be provided. Charge-back mechanisms have been refined over the years and appear to be working reasonably well. The staff resources expended to account for such expenditures also appear properly allocated.

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| <i>Strengths:</i> | <ul style="list-style-type: none"> ✓ Agencies reimburse each other for the cost of assistance provided. ✓ Service rates are tracked at a detailed level. ✓ The basis used for charge-back is to recover costs fairly without being unduly burdensome. |
| <i>Weaknesses:</i> | <ul style="list-style-type: none"> ✓ The charge-back process is not widely understood. |